

# GRAPHIC SCIENCE

THE MAGAZINE FOR DRAFTSMEN

## *Procedures for Drafting Supervisors*

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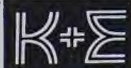
*Photographic Enlargements  
Replace Drawings*

DECEMBER 1959

UNIV OF ILLINOIS  
URBANA ILL  
ATTN: G. WILSON-INSTN IN  
-CENT ENGRG DMG  
CD-EG



# Some Ideas



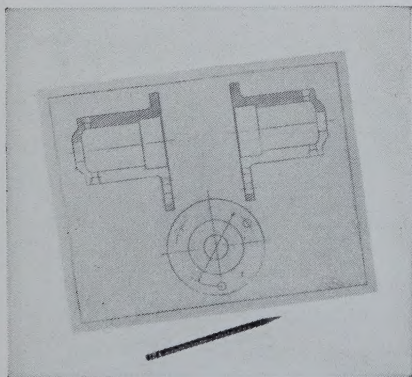
for your file of practical information on drafting  
and reproduction from

**KEUFFEL & ESSER CO.**

A year of relentless testing has produced a small library of interesting facts about HERCULENE (T.M.) Drafting Film. What follows is a consensus of drafting-room experience with HERCULENE—by K&E and its customers—with some up-to-date recommendations for using it. Take the matter of...

## Shiny Back vs. Pencil Back

A basic question is: do you need a double-surfaced drafting film? We make HERCULENE Drafting Film both ways, of course—with a single surface (shiny back) and double surface (pencil back). It's our recommendation that you use pencil back HERCULENE only if it's your practice to make basic drawings on one side, changes on the other. For most other uses, shiny back is preferable. (At first, the double-surface film was chosen by many drafting rooms because it lay flatter on the board than shiny back. This is no longer true. K&E research labs have come up with a fully effective anti-curl treatment.) Especially in filing, shiny back HERCULENE presents fewer problems. The clean non-abrasive back won't smudge the face of the sheet underneath, even in a heavy stack of tracings. If you'd like to compare a few sheets, please let us know.



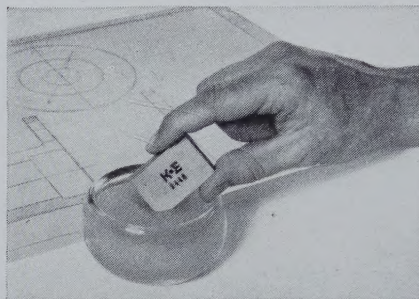
Note sharp clear lines made by Duralar pencil on HERCULENE Drafting Film.

## Plastic Pencils and the HERCULENE Surface

Not just a handy catch-phrase, when K&E puts its exclusive "engineered surface" on a drafting material, the result is an exact, uniform tooth for sharp pencil drawing, inking and typing. With HERCULENE Drafting Film, however, an entirely new type of plastic (non-graphite) pencil yields especially good results. Quite a few of our customers have reported favorably on the well-known Staedtler "Duralar" brand. Duralar pencils come in five hardnesses, are non-smudging and have generally good covering power, sharpness and erasability. After about 20 prints, the Duralar lines show up consistently better than those made by a regular pencil, since graphite lines tend to lose density.

## Wet That Eraser!

The erasing qualities of HERCULENE Drafting Film are excellent, but (as with the pencils) we've discovered it's a new type of vinyl eraser that gives the best results. Examples of these non-rubber type erasers are the Richard Best "TAD" and the Eberhard Faber "RACE KLEEN"—both available from your K&E dealer. With vinyl erasers, pencil lines whisk off. Even stubborn ink and typing can be removed easily, with no damage to the surface. Here's a tip on how to do this:

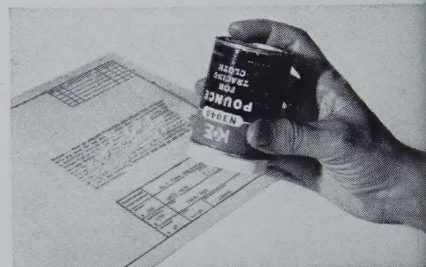


Moisten the eraser slightly. It becomes no more abrasive, but a lot more "erasive." Moistening is a must when removing Duralar lines or typing after exposure to heat. (Incidentally, don't use electric erasing machines, steel erasers or typewriter erasers.) When erasing large areas, certain chemical eradicators work fine too. Our suggestion: use Vythene or a very light application of a denatured alcohol such as Solox, both of which can be applied with a cotton swab or clean cloth.

## The Cleaner the Better

HERCULENE Drafting Film was designed for ink work, and its ink take is unexcelled. But like all films, its non-absorbency makes a few preparations advisable. The surface should be cleaned thoroughly before inking. Quickest and most effective way to do this is with the ABC Draftsman's Dry-Clean pad, which will remove finger marks and "traffic film" simply by rubbing the pad over the surface. Pouncing will also work well. A damp cloth is all right for general cleaning, but does not do the best job of preparing the surface for ink.

Inking over graphite pencil lines comes out best when done over light lines, drawn with a harder grade of pencil. A good way to remove excess graphite is to go over the drawing with an ABC pad. Inks vary in their usefulness on HERCULENE. We've tested several, and you're welcome to these results as well, on request.



## After Typing, Please Pounce

Typed impressions on HERCULENE Drafting Film are crisp and sharp, but may take a while to dry because the film's surface doesn't "swallow" ink readily. A light pouncing right after typing will dry the ink and fix the lines—giving you uniform permanent contrast.

A new typewriter ribbon will produce the best impressions. At K&E we've tested a healthy variety of ribbons and we'd be pleased to send you the results on request.

## Outstanding Advantages Proved in Tests

We're pleasantly amazed at the short time it took for HERCULENE Drafting Film to become an accepted "staple"—along with ALBANENE® Tracing Paper and PHOENIX® Tracing Cloth. Actually, it's a rare drafting room by now that has *not* tested HERCULENE during its first year on the market. The findings: All properties considered, HERCULENE stands up better than any other drafting film. It has great resistance to heat, aging and abuse. Its exclusive "engineered surface" plus its tough, durable Mylar® base provide superior pencil and ink take, fine erasability, remarkable dimensional stability...a combination we're proud to call unbeatable!

The K&E dealer near you has HERCULENE now. Stop in and see him.

**KEUFFEL & ESSER CO., Dept. GS-12, Hoboken, N. J.**

Please send further information about HERCULENE Drafting Film. I'd like samples too.

Name & Title \_\_\_\_\_

Company & Address \_\_\_\_\_



# GRAPHIC SCIENCE

THE MAGAZINE FOR DRAFTSMEN

DECEMBER 1959

VOLUME I NUMBER 3

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GRAPHIC SCIENCE—offering complete coverage of drafting, technical illustration and reproduction for chief draftsmen, supervisors and instructors.

GRAPHIC SCIENCE is published monthly by Kinelow Publishing Company, Inc., 103 Park Avenue, New York 17, N. Y. (Murray Hill 5-1745). Charles E. Rhine, president; C. Paul Yake, vice president; David Z. Orlow, secretary-treasurer. GRAPHIC SCIENCE is published (printed) at 116

Main St., Norwalk, Conn. Address changes, undeliverable copies, and orders for subscriptions should be sent to 103 Park Avenue, New York 17, N. Y.

Postmaster: Form 3579 requested.

Subscription rates: \$8.00 per year in the United

States; \$9.00 per year to Canada; \$10.00 per year to other countries. Single copies: \$1.00.

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# Letters

Sirs:

Through the courtesy of one of our friends in the United States, we have received a copy of the first issue of your new magazine. We have studied its contents with great interest and congratulate you, not only for the valuable information presented in your magazine, but also for the excellent idea of creating a special magazine for draftsmen.

We trust that you share our opinion that the profession of draftsmen, though most important and decisive in any project, generally has not yet found the acknowledgment and the social appreciation which this profession should have, compared with others requiring the same educational standard. One of the reasons for this is that this profession and its most important task is not sufficiently known to the public.

Another, even more decisive reason, is that the directors and boards of industrial concerns still do not sufficiently bear in mind that "every project starts on the drawing board." Since design work cannot be measured by means of a stop-watch, like the manufacturing operations on the premises, drawing offices are only too often considered as a mere cost factor. As a false consequence, the responsible management cuts down the expenses for their drawing offices as much as possible and draftsmen still have to work under unpleasant and unhealthy conditions with outdated and inefficient equipment.

All over the Western world you will find a lack of skilled draftsmen and designers and the tendency of technical students, after their examinations, to start their profession either in production or as technical salesmen; they do not like to start a design job, even though this occupation is well paid. Many managements have not yet noticed and considered that with pleasant and modern working places and modern, efficient and comfortable (health-saving) drafting equipment. . . . they will not only

keep and attract draftsmen, but automatically also increase the efficiency of their drawing offices.

As the world's largest manufacturers of precision drafting equipment, we have always considered it as our duty not only to create first-class equipment, but also to contribute to the general technical development and to the improvement of working conditions and efficiency in the drawing office especially. Considerable research work has been done by ourselves or sponsored by us not only in Germany, but also in the United States and many other countries in this respect.

Hoping that the contents of our letter . . . will be of interest to you, we are, Dear Sir,

FRANZ KUHLMANN KG  
Prazisionsmechanik Und Maschinenbau  
Wilhelmshaven, Germany

Sirs:

There has always been a need by the engineering profession for a magazine such as yours. I believe that your journal will promote a science that hitherto has not received the professional recognition it justly deserves.

ROBERT F. SCHUERER  
Merck & Co., Inc.  
Rahway, New Jersey

Sirs:

This type of magazine is an impressive idea and should "catch on." Each drafting reader, however, will pursue the magazine not only from the standpoint of general drafting interest, but from a personal angle, i.e., how can he benefit? Long articles of a specialized nature are apt to "hog" the show. You might consider more variety and diversification. Wladaver's page beats the drums for all. You can't use too many of these.

Would like to see a rebuttal section. Invite participants to mail in personal views and reactions.

Draftsmen are definitely on the threshold of a new era. Sputnik has released a hue and cry for the pseudo-scientist and as he is produced, the draftsman can be promoted to a new status if he is prepared to recognize and accept the challenge now unfolding before him. It is a matter of moving in and taking over.

E. W. JACUNSKI  
Dept. Engineering Graphics  
University of Florida  
Gainesville, Florida

Sirs:

We find your new magazine a very interesting and helpful publication. Enclosed please find a reasonable facsimile of the subscription questionnaire. . . . We do not meet the letter of any one of the four categories for free subscription but we believe that we exceed the intent of them. I've been in the drafting field for 22 years. Before taking my present position (Specialist-Standards) I was supervisor of drafting for another General Electric Company department.

While we do little or no printed circuit work at KAPL, a portion of the article starting on page 16 was of interest to us. They spoke of using acetate-based ink on polyester film. Can you tell us the name or other identification of the ink they are using and where it may be obtained?

A. L. COMSTOCK  
Knolls Atomic Power Laboratory  
Schenectady, New York

Sirs:

I liked and was very much interested in your first copy of Graphic Science and I am sure that it can and will prove to be very helpful and useful in the future.

CALLA WALSH  
Ford Motor Company  
Highland Park 3, Michigan

Sirs:

I have just finished reading Volume I, Number I of Graphic Science and wish to extend my congratu-

*(Letters to the editor should be addressed to 103 Park Avenue, New York 17, New York. Names will be withheld upon request but all must be signed.)*



tions to you and your staff for the fine articles appearing therein.

It is time that the draftsman finds his rightful place in the sun; and I firmly believe that your magazine will be very instrumental in seeing that he achieves that goal. For too long, has too little importance been placed on the role of designer and draftsman in the world of Engineering.

CHARLES J. MERKLE

General Electric Company  
Philadelphia, Pennsylvania

Sirs:

First congratulations. Around our shop we think you're turning out a good sheet. However, by your rash action in requesting ideas and suggestions from your readers, you're asking for a flood. Our drop of water in this tide is the following: We'd like you to publish "The Complete Check List," subtitled "What does a Checker Check for when a Checker Checks a Drawing?" We believe we're not alone in wanting such a ready reference list. Many thanks for the alacrity with which we know you will respond to this request.

LEE ROTH

Rau Fastener Company  
Providence 7, R.I.

Sirs:

I was very pleased to receive the first issue of Graphic Science and equally pleased to note Mr. Bayer's article. . . . This magazine will be most informative to those draftsmen and designers in our four engineering sub-sections and our reproduction area.

F. R. HUBBARD

General Electric Co.  
Louisville, Kentucky

Sirs:

I read with interest the article on "Scribing" for just now a need for this type of film has arisen in my work. The coverage was good and answered many of my questions.

However, there was evident on the part of the authors a definite bias toward polyester film. One can't expect complete impartiality, but an article such as this is of much more value if the defects of a process or of materials are listed along with advantages.

Furthermore, a frank acknowledgment of the good points of competing processes gives a feeling of greater confidence in the data which is presented in favor of the advocated process.

The range of articles was good, and the format was satisfactory. You have made an excellent start. Keep it up. I hope that this is more helpful than a merely complimentary letter.

ROBERT RYAN

American Optical Co.  
Chelsea, Mass.

Sirs:

I am interested in your new magazine. . . . At present I am writing a textbook for draftsmen and am always looking for the latest in techniques and improved methods of drawing. . .

WILLIAM LOHRAND

Lohrand Engineering Service  
Barberton, Ohio

Sirs:

This is by far the most interesting magazine that I have run across in a long time. I (and other draftsmen, I suppose) have had to glean the latest developments in the graphics field from a variety of trade magazines and advertisements. Having worked in small companies for the past 15 years, I have not learned some of the techniques and short cuts that I might have learned, had I been working for larger firms. Your first issue has given me a chance to learn about scribing, and how other companies make their printed circuit masters.

Thank you for publishing a most informative magazine for the "Forgotten Man"—the draftsman.

GEORGE C. BURKHARDT

Quan-Tech Laboratories  
Boonton, New Jersey

Sirs:

I received your November issue today, and was more than pleased to learn that such a publication has at last arrived. Schmidt's article on Photo-drafting was both interesting and enlightening.

Congratulations on a job well done.

JERRY C. WIESNER

Standard Motor Products, Inc.  
Long Island City, New York



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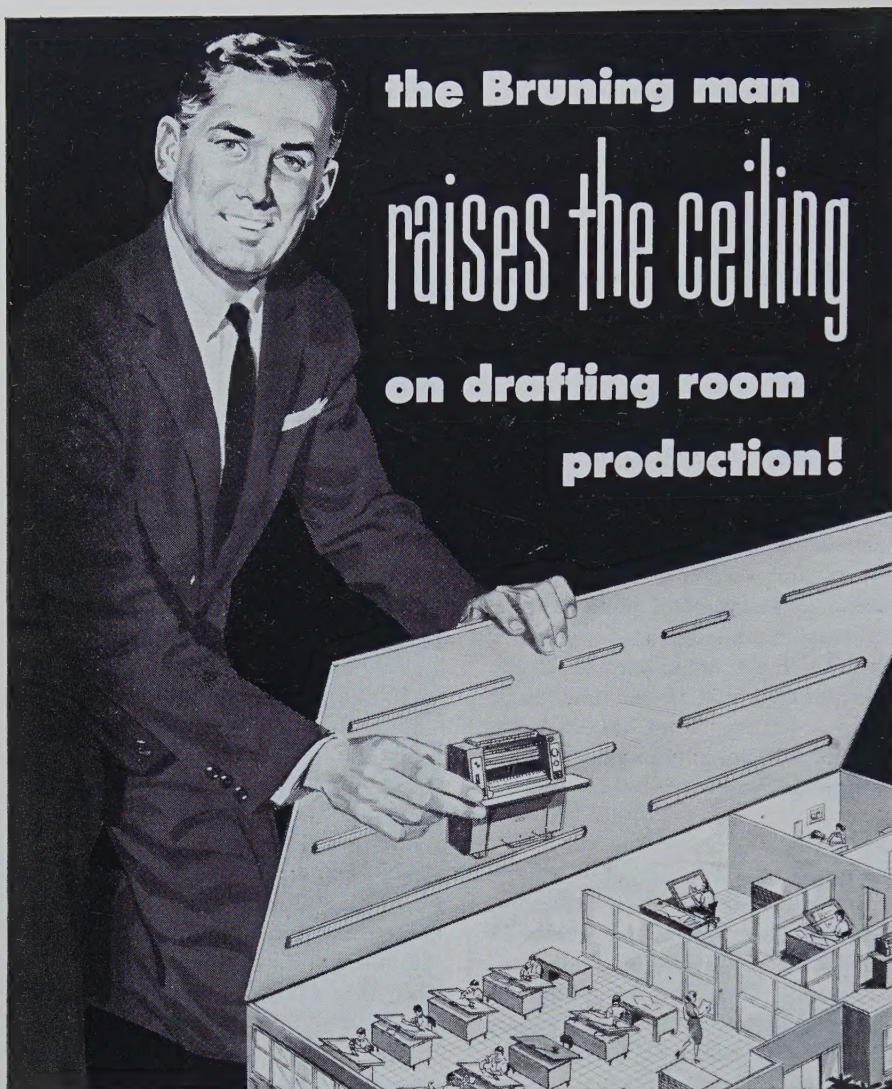
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## Notes & Comment

### Your Subscription

**T**HE QUESTIONNAIRE appearing on page 31 should be filled out and mailed to us if you've not already sent a copy.

For the statistically-minded, analysis of the first 625 questionnaires received from the October issue showed that the "average reader" is responsible for a department of more than 40 men.

### Programs of Interest

**T**HE THIRD Annual International Visual Communications Congress is scheduled for New York December 3, 4 and 5. Program covers several aspects of engineering drawing handling and reproduction, will also be a showcase for exhibitors.

Next Spring: A seminar on Aids in Design Room Management will be held at the University of Illinois in Urbana April 28 and 29. Tentative program lists topics on Drawing of Printed Circuits; Use of Models as an Aid in Design; Auditing Drafting Work and Management; Statistical Control of Tolerance; and Micro-filming. Details? Write Department of General Engineering, University of Illinois, Urbana.

### 3M Buys Assets of Filmsort

**P**URCHASE of the assets of Filmsort Co., a division of Miehle-Goss-Dexter, Inc., has been announced by Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Filmsort has a patented method of mounting individual microfilm frames in aperture filing cards; this system is used extensively for engineering drawings. Microfilm reader-printers marketed by 3M make microfilm enlargements automatically, also provide users a means of fast examination of microfilm records. According to the announcement, operations of Filmsort, presently located at Pearl River, New York, will be shifted to another site within six months, in the interest of efficiency. D. W. McArthur, general manager of Filmsort, will continue to head up the organization, which will be operated as a division of 3M.



# Photographic Enlargements Replace Drawings

*Advanced drafting techniques simplify  
motor control building at Cutler-Hammer*

by J. E. Jones

**M**OTOR CONTROL BUILDERS have put a great deal of effort into the simplification of drafting work on control panels and diagrams. This has been a very real problem because a high percentage of motor controllers are custom built with little probability that there will ever be exact duplicates.

The effort required for the design and building of a large volume of custom controls and control systems requires short-cuts and methods simplification to meet a competitive market. Yet all jobs, regardless of quantity, require: complete specifications for the job; provisions for changes during processing; sufficient fabrication records so that duplicates can be produced later on, if required; and adequate records of components and circuits so the equipment can be serviced over a period of years.

Design and production of a control panel or control system requires team action within the company; steps involved consist of:

1. The engineer's sketch in schematic form of the circuitry.
2. The engineer's selection of the panel components needed.
3. The layout drawing showing the arrangement of components on the panel and the mechanical fabrication data.
4. The wiring diagram showing the panel wire between component terminals and all installation connections.
5. Fabrication of the steel panel, consisting of drilling and tapping for component mounting screws, forming the edges, and painting.
6. Mounting the components on the panel and wiring the control.
7. A functional test of the completed control.

## PREVIOUS TECHNIQUES

**C**ONVENTIONAL drafting methods used in the past depended upon layouts of templates to determine size and locations. Sketches were made from the layouts and these sketches were used by draftsmen to make panel drawings. The panel drawings gave complete fabrication data for the shop.

The shop people had a time-consuming job of translating the drawings to machine operations. When the device mounting holes were to be drilled in the steel panel on a drill press, it was necessary for the shop layout men to transfer all dimensions from the drawings to the steel panel blank and center punch for the drill locations. Layout effort of that type is costly.

More recent shop methods employed turret punch presses to punch rather than drill the device mounting holes. The press operator was given a chart which listed the turret press settings. The preparation of the chart from conventional panel drawings was time-consuming because of reference to device drilling drawings and the arithmetical computations involved.

In making a diagram from an old conventional panel drawing, the draftsman had to plan the sizes and arrangements of the device symbols. He would then either draw the electrical symbols or use stamps. The setup before drawing any wiring lines amounted to an average of 15 per cent of the total diagram drafting time.

We, at Cutler-Hammer, Inc., are now using two improved methods of processing panel drawings and diagrams. The method selected in each

case is dependent upon the nature of the equipment and the process time.

## FULL-SCALE TEMPLATE SYSTEM

**U**SING the full-scale template method the job or specialty shop can handle, on a short production time basis, controls which utilize adjacent stocks of highly repetitive components, panels and enclosures. This method is based upon the use of full-scale templates for panel fabrication.

The drafting department and fabrication shop techniques employed by this method were developed to streamline the procedure for fast handling of job-shop type orders. The objective: to by-pass time-consuming delays in all departments and particularly in the design and sheet metal fabrication departments.

Our engineers and panel layout draftsmen prefer to work with full-scale component templates. Full scale tends to keep the layout in proper perspective and is especially helpful in making adequate allowance for clearance around components.

We carry a quantity of transparent templates of each control equipment. These templates are produced from carefully prepared masters with special attention given to the accuracy of the mounting-hole dimensions. The masters are coded to indicate the drill and tap sizes for the mounting screws. They also show the electrical diagram symbols and identification numbers of the components.

Horizontal layout surfaces are preferred. The layout table has a grid pattern of 1-inch spaced lines, both horizontal and vertical. A transparent panel template is placed on the table over the grid lines. The engineer has



a variety of sizes of these panel templates corresponding to preferred panel sizes, normally carried in stock.

The component templates are placed on the background in the desired arrangement, grid lines serving as a guide for spacing and accurate location. A small piece of transparent tape at the top of the template provides all the fastening needed and can be easily removed to salvage the layout materials for repeated usage. The engineer in Figure 1 is removing a completed layout from the layout table. The outline of the panel and the mounting holes are drawn permanently on the panel template. The panel components are taped fast. The layout can be rolled for handling.

The completed layout next goes to the reproduction processes department and full-scale contact prints are made from it. Our prints are developed in an ammonia machine and result in satisfactory dimensional stability. Best results are obtained if the printing exposure is made in a flat vacuum frame. There is some loss of dimensional accuracy if the exposure is made by the usual whiteprint machine printing cylinder, but in most cases this is not serious.

One of the contact prints of the layout is mounted on a line camera and photographed. The film picks up the electrical component symbols. An enlargement is later made from the film onto silver emulsion-coated vellum and this serves as the starting point for making the connection diagram. The symbol images on the diagram tracing are usually about 30 per cent of full size. This photographic tracing saves the usual setup time in the drafting department needed to draw, stamp or use adhesive-backed methods to reproduce the symbols from the panel layout.

Full-scale prints of the layout are used in the shop to drill the component mounting holes. A formed and painted panel of the proper size is selected from stock. The layout print is taped down to the steel panel as shown in Figure 2. The workman center-punches the hole locations through the locations shown on the print. He then drills through the paper and the steel. The chips pile up on the paper so that the painted surface of the panel is not marred. Code letters on the layout indicate the drill and tap sizes.

This procedure eliminates the need



FIGURE 1. Full-scale paper templates for shop are made from transparent master.

for a panel layout drawing. It has the advantage of eliminating errors both in the drafting department and in the shop. All shop layout and scribing work is eliminated. The list of material supplied by the engineering department and the scale diagram on a permanent tracing comprise a complete record of the job.

#### PHOTOGRAPHIC PANEL DRAWING SYSTEM

**T**HE SECOND METHOD involves the use of a photographic system which has almost no limitation as to

panel sizes and shapes and as to the variety of components needed. It is coordinated with modern metal fabrication methods and can lend itself to additional automatic features, if they are justified. It was developed to handle the regular run of special control panels, utilizing the preferred shop scheduling and machining methods. It eliminates the use of the large sheets of paper necessary for full-scale template work.

In the drafting department, the objective was to simplify the layout and panel drawing and to reduce the draft-



ing effort required to make the wiring diagram. The system adopted utilizes a panel layout drawing produced entirely by photography. Photographic processes are also used to reproduce the diagram symbols on vellum to give the draftsman the basic component layout for use in making the connection diagram.

Figure 3 shows the method of making the panel layout. The templates are printed in two colors on card stock on an offset press. These templates are full-size and the mounting dimensions are accurately shown. The electrical symbols and all the features needed on the wiring diagram are printed in one color. The mechanical information consisting of hole sizes and locations and tap sizes are printed in a second color.

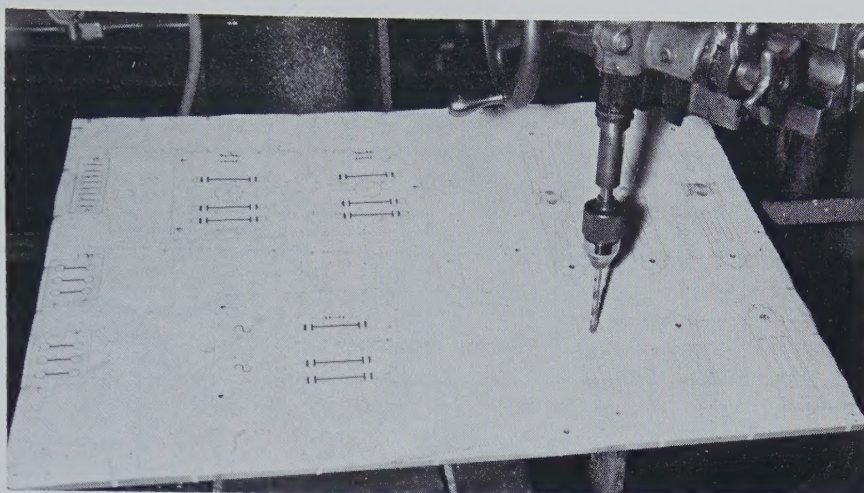
Different combinations of colors will work satisfactorily if coordinated properly with the types of lighting and film employed. The object is to get mechanical information from one exposure and electrical information from another, both taken from the layout, by color separation. The layout table grid-lines use the mechanical information color.

The dimensioning system is coordinated with the shop processing method. The panels are made from sheet steel and are usually formed over at the edges for stiffness. The forming is done after the holes are punched. One corner of the flat sheet of steel is the reference and all locations are made by rectangular coordinates from that corner. The hole location lines are, by agreement, either on the inch lines or on  $\frac{1}{2}$ -inch lines. Smaller increments must be dimensioned. All hole spacings on the templates are dimensioned.

The outline of the panel on the layout table is formed by strips of paper board on which the inch markings are indicated. The templates are not fastened down to the table surface.

We use a fixed-lens camera mounted above the layout table. It has a 150-inch field at table level. The film holder can accommodate 14 x 17 film. The reduction ratio is fixed at 8:1.

When a layout is finished, the camera operator takes two pictures. One picture picks up both layout colors and is used for the panel fabrication. The other picks up only the electrical diagram information. Enlargements are made from these films for further processing.



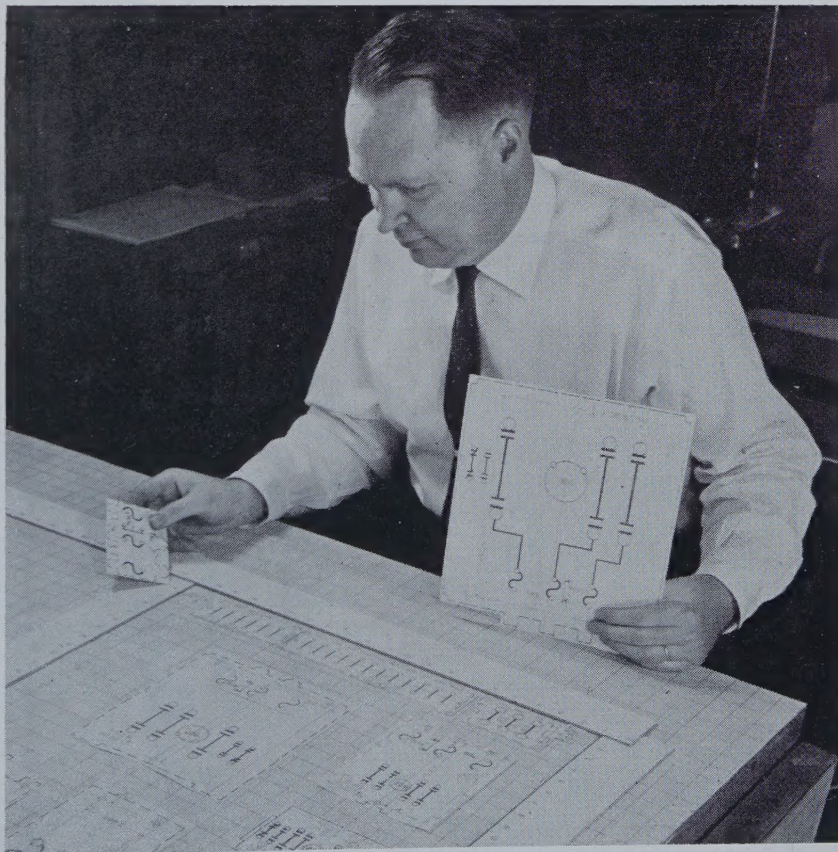
**FIGURE 2.** Panel component mounting holes are drilled directly from full-scale paper template of layout, thus saving considerable drafting time at Cutler-Hammer.

Figure 4 shows the working enlargement which is used in place of a panel drawing. This is usually projected from the film onto silver emulsion-coated vellum. Whiteprints can then be made as required from the vellum.

Figure 5 shows an enlargement of a portion of the same layout made from the electrical symbol film. Note

that the layout table grid lines and all mechanical information are eliminated. This layout is projection-printed on vellum. We usually project the title block along with the symbols onto the sensitized vellum. A considerable saving in drafting time is realized when the setup work is eliminated by this method.

The lower left-hand portion of the



**FIGURE 3.** In photographic panel drawing system, full-scale templates—printed on card stock—are arranged in position on layout table for photographing.











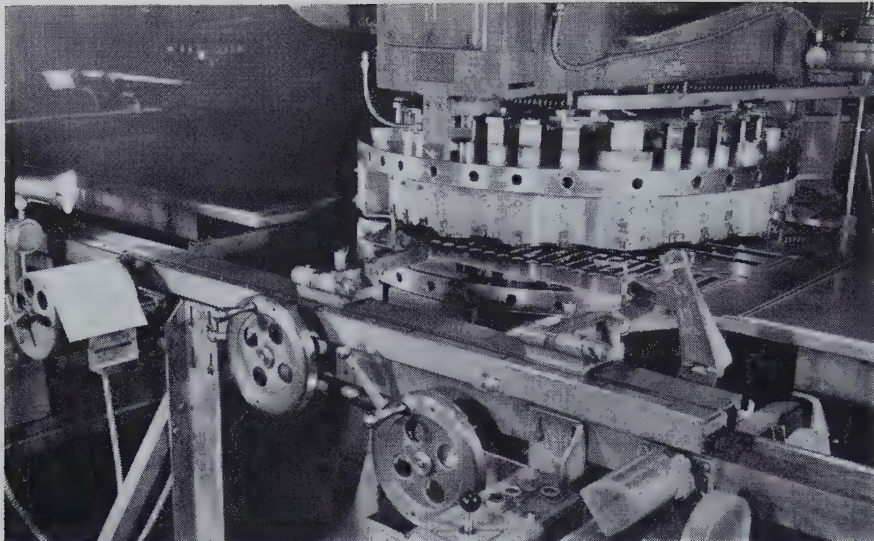


FIGURE 7. The motor-operated turret press, used to punch component mounting holes in the steel panels, is viewed from the press operator's station.

mechanical information enlargement is shown by Figure 6. We have added point 0-0 and dotted lines to indicate the actual corner of the flat steel blank before forming. All location dimensions read up to the right of corner 0-0. This print is used in the shop to prepare a chart for the turret press used to punch the holes and other features in the panel.

The turret press chart has three columns of data. One column shows the horizontal location of the hole, another the vertical location from 0-0. The third is the tool or station designation on the press turret which will punch the proper size of hole.

Referring to Figure 6, the lower panel mounting hole is .505-inch diameter and located 2 vertical and 2

horizontal. The terminal block immediately to the right of the .505-inch hole has two No. 8-32 tapped holes for mounting screws, one located 3 vertical and 2.50 horizontal, the other located 2 vertical and 5.75 horizontal. The 5.75 dimension is the sum of the 2.50 reference line location plus the 3.25 hole spacing shown on the terminal block template. A typical turret press chart would be tabulated about as follows:

Horizontal	Vertical	Tool
2	2	24R
2.50	3	3J
5.75	2	3J
3.50	5	11R
6.375	5	11R
5	10.625	11R

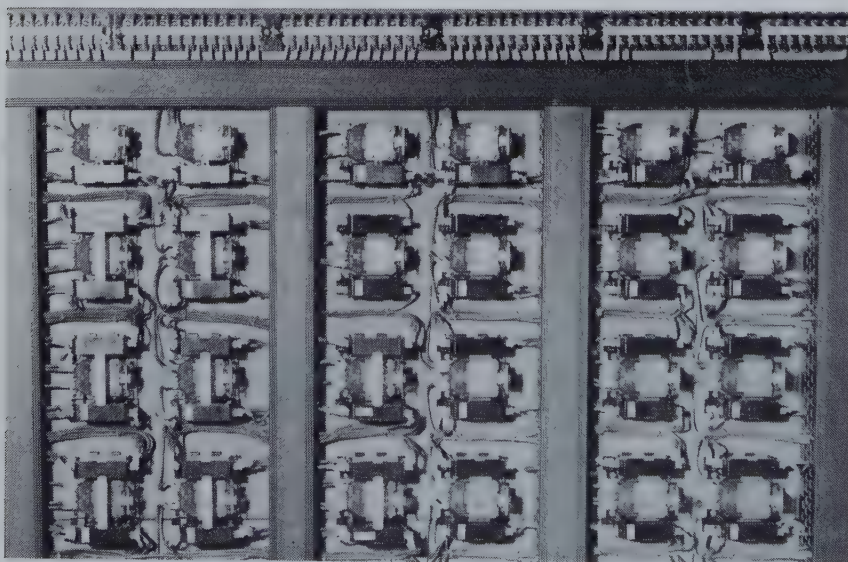


FIGURE 8. Typical custom-built motor control construction at Cutler-Hammer utilizes front removable components and troughs for the panel wiring.

A sheet of steel is shown in position on the table of the turret press in Figure 7. The chart which the press operator follows in punching the panel is shown on its holder at the left of the photo. The handwheels which set the coordinate locations are shown in the center foreground. The operator sets the vertical and horizontal locations using the micrometer scales on the handwheel rims. He manipulates a motor drive to position the proper tool, then steps on a foot pedal to operate the punch.

The photographic panel drawing eliminates the conventional form of drawing completely. All fabrication data are reproduced photographically. Turret press charts are quickly prepared because all dimensions are direct-reading. The panel enlargement is helpful in the assembly department to assist the workmen in mounting the components, since it is really a scale picture drawing. All layout work on the panel is eliminated in the shop. The punching operation on the turret press is faster than drilling.

#### SUMMARY

OUR COMPANY has seen fit to retain both methods described above. The full-scale template method does not require special photographic facilities or special machinery, and therefore, is adaptable to specialty shop operation. The photographic method is well-suited to more extensive operations. It can handle a large volume of special jobs coordinated with the usual modern manufacturing equipment and procedures.

Figure 8 shows a portion of a completed control panel. Each contactor shown is held to the panel by three mounting screws. The panel holes are tapped, making the devices front-removable. All panel connecting wires are carried in wiring channels for convenience in wiring and servicing. Outgoing connections are carried to terminal blocks shown on the right side of the panel. This type of panel construction is regularly produced both by the full-scale template method and by the photographic method.

#### The Author

J. E. JONES is Manager of the Drafting Department at Cutler-Hammer, Inc., Milwaukee, Wisconsin.



# Recruiting and Training Draftsmen

*"The value of a drafting room . . . can only be measured by the additional or exceptional responsibilities that (it) is capable of assuming over and beyond the normal drawing work."*

by L. E. Tepper

NEWS PUBLICATIONS and professional magazines have given a great deal of publicity during recent years to the importance of the engineering profession to the country's future economy and security. Much has been written exploring the lack of enough engineers to satisfy demands, not alone for the present but also for the future. Virtually no publicity, except for the notices in the want-ad columns, has been given to the corresponding shortage of draftsmen and designers.

The two problems, although related, cannot be solved by the same methods. The shortage of engineers can only be alleviated by inducing a greater number of qualified high school graduates to continue their educations in suitable engineering institutions. Draftsmen, however, usually with limited educational backgrounds, must gain proficiency in their vocation by other means.

Discerning management, aware of the situation, has taken steps to satisfy future drafting and technical personnel requirements by establishing training programs, many of which have become quite extensive. Such programs not only insure an adequately trained personnel to guarantee

the future needs of an organization but also give the apprentice the opportunity to establish himself in a vocation which will offer him a challenge and the prospects of a rewarding career.

## THE DRAFTING VOCATION

THE END PRODUCTS of an engineering organization are drawings. These drawings reflect the combined efforts of the engineering staff and the drafting personnel, and they provide industry with the detailed instructions for building its structures and producing its products.

It is the prime responsibility of the drafting room to produce the drawings neatly and correctly in the most economical manner. However, the value of the drafting room to an organization's activities can only be measured by the additional or exceptional responsibilities that the drafting room is capable of assuming over and beyond the normal drawing work.

A drafting room well-staffed with highly technical, competent personnel can prove invaluable to an engineering organization by relieving the engineering group of all except the more complicated, basic design problems.

To achieve this ability in a drafting room, a diversity of skills, resulting from varied educational backgrounds, training courses and experience are required.

Both experienced and apprentice draftsmen are a prime requirement in all drafting rooms in order to perform economically and efficiently the actual drawing work.

A few draftsmen in any group, either by choice or inaptitude in design work, never seem to progress beyond the ability to make good drawings. They may be excellent and efficient draftsmen but never become designers or supervisors.

Others, by conscientious application, study, and experience become expertly qualified designers capable of performing the more complicated design work, and develop into candidates capable of filling supervisory positions. This man is the backbone of the drafting room and is the type of individual that an organization must strive to produce by suitable encouragement and training.

There are others in a drafting organization who by continuing their academic education, either by attending evening classes or by other means, will eventually receive engineering de-



grees and will then either move on to more responsible positions in their chosen profession or will progress into supervisory positions in their own drafting room. Those who accept engineering positions in their engineering organization find the time spent in the drafting room an invaluable aid to their future careers.

#### INDIVIDUAL RESPONSIBILITIES

WHEN AN INDIVIDUAL is referred to as an engineer there is little misunderstanding as to his position in an organization or in a community. But because of the wide variety of skills and responsibilities necessarily assigned to men in a drafting room, some confusion arises as to their exact status. All who are employed in a drafting room are referred to as draftsmen.

The general acceptance of a title such as "Design Department" instead of "Drafting Room," would help immensely to clarify a vexatious and aggravating situation. Personnel doing drawing work only would of course still be referred to as draftsmen. The term perfectly describes their occupation.

The more experienced, technical people however would be known by titles more in line with the actual work that they perform. My firm, cognizant of the situation and endeavoring to recognize services by appropriate titles, has attempted to identify our various employees by their individual work performances. Unfortunately, no distinction is apparent to anyone outside of our own company. The following gives a brief description of the various titles and individual work categories that have been used by our company.

*Squadman:* Under the supervision of the chief draftsman and in consultation with the project engineer, he plans and supervises the work of a group of designers, checkers, draftsmen and apprentices on a major project. He is responsible for the preparation of design sketches and final construction drawings, and if necessary, coordinates the work with other groups.

*Checker:* A checker verifies the accuracy of the design, detail and dimensions of the work as shown on the construction drawings.

*Designer:* Under the direction of the squadman, he lays out and prepares the detail design of the various

phases of a project. He leads and advises the draftsmen preparing the actual construction drawings.

*Draftsman:* Under the direction of the squadman and in cooperation with the designer, he plans and completes the actual detail drawing from design sketches and other data placed at his disposal.

*Apprentice Draftsman:* Under the direction and close supervision of the squadman and designer, he performs elementary drawing work and tracing. Usually, he attends one or more training courses designed to acquaint him with the work of the organization and to teach him the fundamentals of the work that he is doing.

*Clerk - Trainees:* Most drafting rooms employ young men for clerical duties, who in addition to acting as clerks, will perform simple drawing tasks, such as stenciling titles on drawings, making checking changes on drawings, etc. Usually they will attend classes in drawing techniques, and when they are considered qualified, will progress into regular and steady drawing board work as apprentice draftsmen.

*Miscellaneous:* There are other incidental but important work assignments in many drafting rooms. Major projects may demand the full time services of men to list and order material. One man or more may be required to devote all of his time to preparing and editing standards. Other specialists may be required for certain repetitive phases of the work that will vary from job to job, and from company to company.

#### OPPORTUNITIES

THE ADVANTAGES open to a young man beginning a career in drafting are many and varied. Draftsmen who possess an advanced academic education or who, through extra curricular study and experience, qualify themselves, will eventually become excellent candidates for more responsible positions.

Those who begin their careers with a less formal education and who demonstrate willingness to apply themselves diligently will find that many organizations provide opportunities for furthering their education.

Most organizations will accord draftsmen working for them the recognition deserved of professional people: the draftsmen are treated with respect and understanding and

their personal problems are of deep concern to the management, the same as with the organization's other valued employees.

The salaries of draftsmen in the majority of engineering companies are usually considerably higher than the salaries of workers in other white collar positions. This results in a better than average standard of living for draftsmen and their families.

Working conditions, are in the main, better than average, with adequate working space in clean air conditioned offices. Many other facilities and benefits are normally provided for the draftsman's comfort.

#### RECRUITING

REPLACEMENTS in the drafting room must be made to maintain a competent, well-trained drafting staff. This can be done by hiring experienced men from outside the organization or by promoting qualified men from within the company.

Due to the shortage of experienced draftsmen and designers during the past decade it has become increasingly difficult to fill vacancies from outside sources. The most reliable source for replacement of qualified personnel is by the advancement of men already employed and trained in the organization.

In order to accomplish this, a constant replenishment of apprentice draftsmen is required for training, so that they can gain the necessary experience.

Recruiting therefore concerns the selection for employment of comparatively inexperienced young men with varied educational advantages, who are searching for a career and who are considered to be suitable prospects for positions in the engineering profession as draftsmen.

#### QUALIFICATIONS

THE SELECTION OF MEN for employment and training by an organization is important. Every embryonic draftsman who fails to qualify after the prescribed training represents a financial loss to the company and a waste of valuable time to the individual. Suitable tests and astute questioning during employment interviews are mandatory if such losses are to be kept to a minimum. The interviewer must not only be able to judge an applicant's general intel-



ligence, ambition, etc., but also to evaluate his suitability for a technical career.

In addition to the normal desirable attributes, such as ambition, health, behavior, etc., the following requirements can normally be expected to produce the most desirable candidates for careers as draftsmen and designers. (1) The candidates should preferably be between eighteen and twenty-five years of age. (2) They should have a high school education or equivalent. (3) They must exhibit a definite interest in engineering and drafting.

#### SOURCES OF PROSPECTS

**T**ECHNICAL high school graduates who have a definite desire for an engineering career but who are unable to continue their formal education are excellent potential draftsmen. The majority of these graduates will normally seek positions as draftsmen, hoping to be able to continue their education at a later date and gain valuable experience in the meantime.

Not to be overlooked is the large number of high school graduates who have no particular leaning toward a specific future career. Among them are many who, when given the proper incentive and opportunity, will find themselves admirably adapted to a rewarding career as a draftsman.

Other sources of prospective draftsmen are the trade and vocational schools where mechanics and mechanical drawing are taught. The instruction these students receive in drawing and blueprint reading makes them excellent candidates for employment as apprentice draftsmen. Other prospective draftsmen are those young men who have not become available immediately upon graduating from school. Many enter military service upon graduation, and after their return to civilian life, are anxious to succeed in a promising career. Others accept positions in other phases of business upon graduation and later are eager to begin a vocation which they hope will be more to their liking. It is not unreasonable to assume that many suitable candidates for a drafting career can be found among this group of prospects. Careful and thorough interviews should reveal such prospects.

With reference to military service, no restriction should be placed upon the employment of graduates who are

eligible for compulsory military service. Such men, if considered good prospects, should be employed and trained in the same manner as any other apprentices. The majority of those who will enter and complete their military service will return to resume their interrupted careers.

There is a pressing need for drafting room personnel with a more advanced technical education than that possessed by high school graduates. In addition to the men with accredited engineering degrees, those with two or three years of college education make excellent candidates for the technical work normally done in many drafting rooms.

#### CONTACTING PROSPECTIVE APPRENTICES

**V**ARIOUS METHODS may be used to inform prospective apprentices of the opportunities available to those who will adopt drafting as their vocation.

Job opportunities and work benefits should be made known to local high school, trade and vocation school student counsellors and teachers. If properly impressed, they will be happy to inform their students of the available openings and also will arrange for group informatory sessions to stimulate interest in the opportunities available. Those with sufficient interest may be invited to apply for personal interviews.

The most commonly used method of contacting prospective apprentices is by the placing of want ads in daily publications. Want ads in weekly neighborhood papers are also usually quite effective, including those published in foreign languages. The ads should be well written, completely describing the work, the opportunities, and the benefits provided by the company.

Another method of contacting prospects is to urge present employees to invite their friends whom they consider interested and qualified to come to the office for an interview.

#### SALARIES

**I**N RECRUITING young men for a drafting career, it is important to be able to offer them suitable compensation in accordance with their individual abilities during their probationary period as trainees. To attract the most desirable high school grad-

uates, the established starting wage must be comparable to the salaries being offered to apprentices in other trades and vocations.

Set periods should be established for salary reviews with definite increases guaranteed to those making suitable progress. This is particularly important when offering an apprenticeship to older men, with the responsibilities that usually accumulate during the years. Unless the drafting apprenticeship wage is adequate to meet their needs, such men will probably be forced to continue working at menial jobs that might offer higher immediate salaries.

Wage scales for inexperienced men with engineering educations should be established in a similar manner to those of high school graduates, except that the base rate should be correspondingly higher.

#### TRAINING

**T**O THE YOUNG APPRENTICE entering employment, a good training program offers the opportunity to develop his abilities and skills, thus enabling him to gain greater economic security and a higher standard of living. On-the-job training and education in subjects closely related to his work is bound to increase his opportunities for advancement and responsibility.

Obviously, industry cannot attempt courses of instruction comparable to the formal courses provided for students in universities. The courses adopted must necessarily be fundamental in scope, designed to augment a limited experience and education. The types of instruction which might be given include:

- a. Drawing classes designed to acquaint the trainee with drawing techniques, the use of drafting tools and materials, and the company's methods.
- b. Courses designed to teach inexperienced draftsmen the fundamentals of the particular work in which they will become involved.
- c. Courses designed for the development of designers and checkers by introducing and informing draftsmen of the more detailed aspects of the fundamentals. Men with more advanced education should be included in these classes, so that they can be shown how to apply their super-



rior knowledge to practicable problems.

#### SARGENT & LUNDY'S TRAINING PROGRAMS

**B**ECAUSE OF THE lack of a sufficient number of competent and experienced draftsmen and technicians to maintain the high quality of work consistent with good engineering practices, our management realized several years ago that they would be compelled to hire men with little or no experience and train them to suit their needs.

It has since become a basic policy with Sargent & Lundy to encourage and assist the employees to obtain additional training and education in every possible way. To promote this policy, the firm has established educational and training programs of both the formal and informal types within the organization. It also has provided opportunities for educational programs outside the organization for selected personnel.

The training programs which have been placed into effect by Sargent & Lundy have proven extremely beneficial, both to the firm and to the participating individuals. A brief description of our programs will exemplify how an organization can provide an adequate number of skilled workers to carry on its work, competently and intelligently.

Sargent & Lundy, a firm of consulting engineers, is concerned primarily with the design and detailing involved in the construction of electric generating stations, substations and transmission lines. They lay out and design the entire plant from the building structures to the various mechanical and electrical components required within such a plant.

The Engineering Department, in addition to establishing the basic design, writes specifications for all of the major components and supervises the construction of the entire project.

The Drafting Department is responsible for all the detail design and drawings, the ordering of all miscellaneous material, and the checking of all manufacturer's prints pertaining to equipment used in the project. Approximately four hundred draftsmen and technicians are normally required in the three separate drafting rooms, namely, the structural, mechanical and electrical drafting rooms.

The training program was initiated

in our organization by establishing an on-the-job course of instruction to be attended by drafting apprentices. The course was entitled "Instruction Program—Power Plant Draftsmen."

Textbooks describing and pictorially illustrating all of the major components involved in power plant construction were prepared by qualified company personnel. For example, one chapter in the electrical series was devoted to transformers. It described and illustrated their construction, their purpose, their auxiliary equipment and where and how they are used.

Another chapter was devoted to switchyards, another to motors, etc. A separate textbook was prepared for the mechanical work with its individual chapters describing the major mechanical components.

The end result was an extremely comprehensive and informative series of instructive treatises for power plant draftsmen. In fact, the books were so well received that many of the more experienced men were eager and anxious to obtain the series for their own study and use.

#### CLASSES

**I**T SHOULD be mentioned that students attending classes and others interested in the program were encouraged to submit comments on the program, on the way the classes were conducted, and on the specific topics. Many illuminating and helpful suggestions were received that resulted in changes beneficial to the individual students and to the company.

A series of one-hour long classes was scheduled during normal working hours on two days a week. The entire course lasted approximately six months. Classes were conducted by instructors recruited from qualified company personnel. The textbooks and illustrations projected on a screen were used as a basis for their instruction. Written and oral tests were given at periodic intervals, and at the end of each series of the electrical, mechanical and structural lectures, and at the conclusion of the entire course.

Trips were arranged to nearby power plants. Some were already in operation and some under construction. This allowed the students to see at firsthand the work in which they would become vitally concerned.

Pertinent to the training course was the decision of the management to

have all draftsmen, regardless of the department in which they were directly employed, attend the entire course. An electrical draftsman, in addition to attending the classes in the electrical series, also would attend and be graded in the mechanical and structural series.

In this way the man could become acquainted with the equipment used in a power plant and with the work performed by others than those with which they were directly concerned. It also provided an opportunity for the individuals to make a choice of the particular phase of the work which they were most interested in, and which they desired to follow during their working careers.

The classes served another useful purpose. It was comparatively easy to evaluate and determine which of the men had worthwhile future potential.

A course in drawing fundamentals and techniques was also inaugurated. The entire course lasted approximately six months and was attended by clerk-trainees for two, one-hour periods per week. Each man was required to accurately reproduce a regular construction drawing in each of the three phases of the company work, either from dimensions furnished or by scaling the original. No direct tracing was permitted.

Competent instructors were on hand to explain exactly why the drawings were drawn as they were, why and how certain sections were taken, etc. The instructors also advised the trainees as to the proper procedures and methods to be followed, and answered all questions. To further excite interest, the trainees were given elementary lectures on electric generating stations, their purpose and their operation. The lectures equipped the trainees to more easily assimilate the instruction given in the fundamental course which they would receive later.

In addition, additional informal classes were organized in the individual drafting rooms to instruct the draftsmen on the detailed design of the components to which they were introduced in the basic course. These classes were conducted by qualified drafting room personnel, and were usually given for one hour each week, and lasted as long as necessary to complete the subject. These courses were attended by selected men, who had exhibited the interest and intelligence to be considered good future

*(Continued on page 29)*



# Integrated Orthographic-Isometric Projection

by Wayne L. Shick

**M**OST PEOPLE know what an isometric drawing is. Professional illustrators also use other types of axonometric drawing—trimetric and dimetric. Both drawing instrument manufacturers and individual corporations have produced plastics angular devices with special scales and ellipses for the easier drawing of certain standardized trimetric and dimetric views. One company makes a complex travelling ellipse machine for axonometric drawing.

But all these devices are for axonometric drawing, not axonometric projection. For the “drawing,” dimensions are read and transferred one at a time in each of the three directions—from the orthographic drawing to the trimetric, dimetric or isometric view. In axonometric projection, however,

the orthographic views are positioned at certain determined angles so that the axonometric view can be directly projected. Figures 1 and 2 show the difference between “drawing” and “projection.”

In Europe, axonometric projection has been an elementary subject for many years. Unfortunately, the method of direct axonometric projection is still not generally taught in U.S. high school and college drawing courses.

In the spring of 1947, our students at the University of Illinois were having difficulty with the layout and long projections at various angles of the axonometric. It appeared that these troubles might be overcome by mak-

ing a standardized board with sides perpendicular to the directions of projection, and axial lines drawn on the board for the positioning of orthographic views. Thus, a T-square could be used to make the long projections; see Figure 3.

In 1949, such a board was made. Several such boards have been demonstrated at the University of Illinois Engineering Open House for a number of years.

## INTEGRATED AXONOMETRIC- ORTHOGRAPHIC PROJECTION

**I**N 1954, six more sides were added to the board for the purpose of alignment of the three orthographic views and for *projection between orthographic views*. This projection could be accomplished by extending

Note: The University of Illinois Foundation has applied for a patent on this invention. The Foundation will license companies for manufacture of the device.

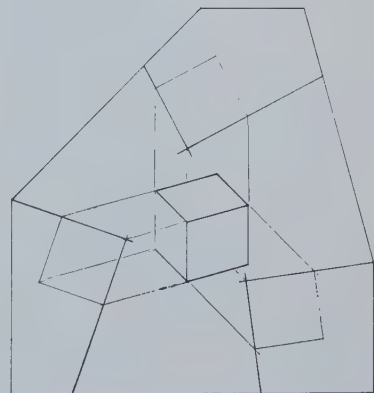
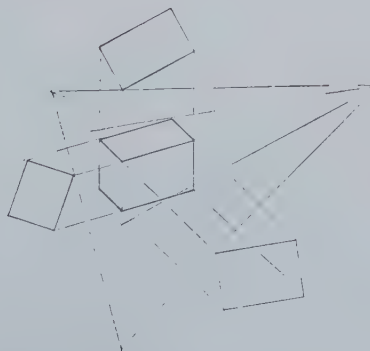
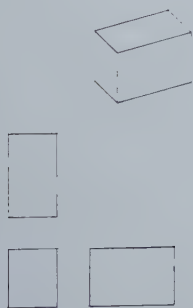


FIG. 1. Orthographic & dimetric drawing.

FIGURE 2. Trimetric projection.

FIGURE 3. Trimetric projection board.



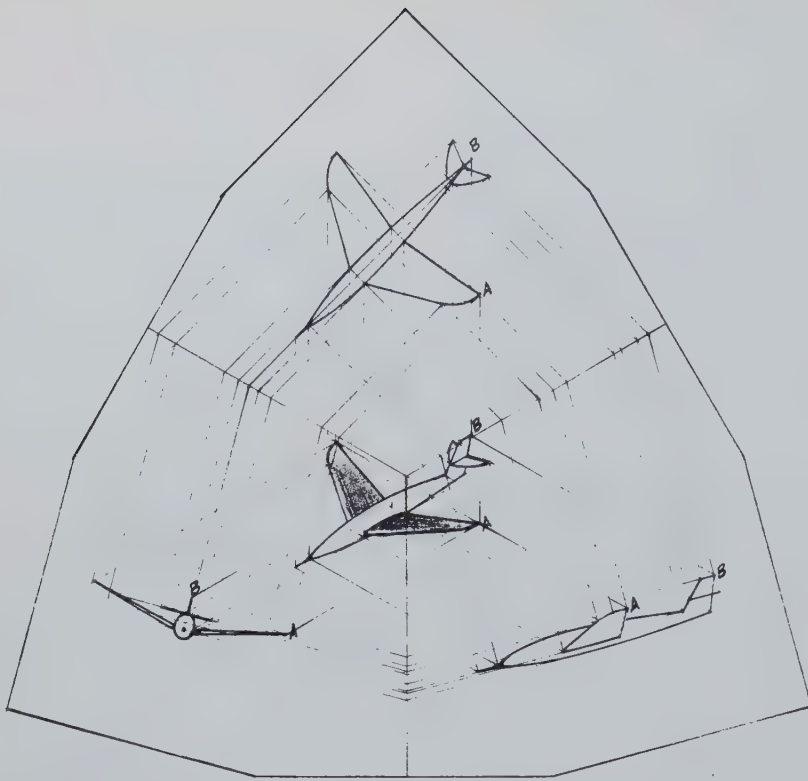


FIGURE 4. Integrated isometric-orthographic projection board.

the projection lines of each view to a mitering line (or transfer line) between any two views. Thus, the orthographic views themselves could be originally drawn simultaneously with the axonometric view. The draftsman would see a three-dimensional view develop while he drafted the orthographic views. Heretofore, we had been concerned only with the projection of an axonometric view from orthographic views previously prepared by conventional drafting arrangement and procedures. This board for integrated isometric-orthographic projection was made in July of 1954; see Figure 4.

The nine-sided board worked well, with only one instrument, the T-square. But it had faults: (1) projection between any two orthographic views required placing the T-square against one side and then another; (2) drafting to and from the miter lines increased time and error of projection between front and top, and front and side views; (3) the paper had to be trimmed to a peculiar shape of limited size; (4) tape used to apply the paper interfered with the smooth operation of the T-square.

#### THE QUADRANGLE

IN FEBRUARY of 1959, a device was evolved which had none of these difficulties. It consisted of two parts of practical simplicity: (1) a quadrangle, and (2) an equilateral triangular frame. The quadrangle can be manufactured by the same process as a conventional drafting triangle. The interior angles of the quadrangle are 60, 45, 150 and 105 degrees. The triangular frame can be one-piece or three demountable pieces; see Figure 5.

The triangular frame is placed in the desired location over a drawing sheet of any size. The quadrangle slides along each of the three sides of the interior of the frame, making direct projections between all four views: top view, front view, right side view, and isometric view. Projections are made without transfer lines or error—truly direct projection. The other principal orthographic views (view looking up, rear view and left side view) and their isometric view can be projected by turning over the drawing and repositioning the frame. A light-table and tracing paper facilitate such drawing of additional views.

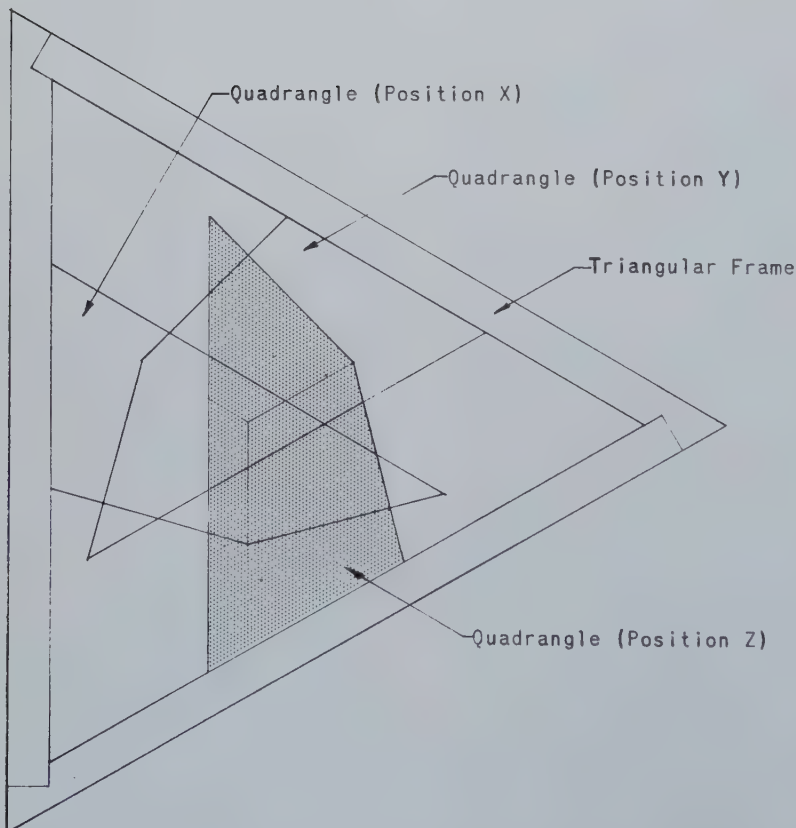


FIGURE 5. Device for orthographic projection.



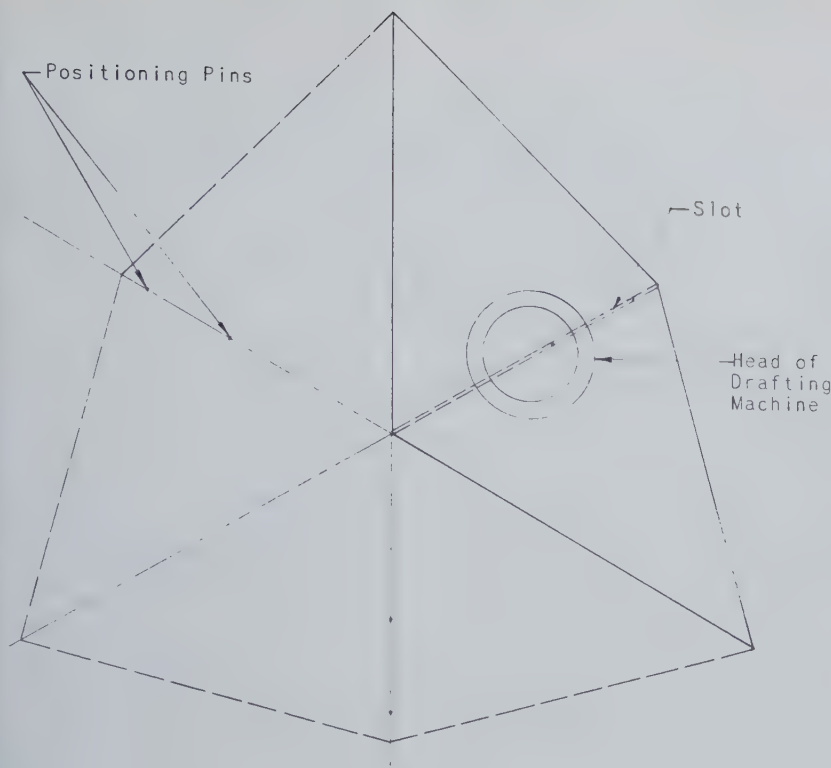


FIGURE 6. Quadrangle for drafting machine, used for orthisographic projection.

#### AN ADDITIONAL DEVICE

ANOTHER device has been worked out for use on the head of a drafting machine. It is slotted to ride on short studs or pins positioned on the imaginary miter lines between orthographic views. Paper can be punched and then positioned on these studs which are not in the area of any of the views. This device will also make direct projections between all four views; see Figure 6.

#### SUMMARY

IN EXPERIMENTAL groups, students have been taught isometric projection with conventional drafting equipment. When one group uses isometric projection and another group uses isometric drawing, isometric projection is some thirty per cent faster than isometric drawing. Projection is also more precise and automatic. Further precision and automation are provided by use of the quadrangle described above.

In industry demonstrations, the quadrangle has detected errors in top and side views on machine drawings prepared conventionally. Such errors should never occur in using the quad-

range, since it automatically registers between all views of the system.

The three-dimensional view in direct relationship to the detail drawings should aid the engineer and draftsman in design concept, and should expedite communication between engineering and production groups. Illustration work may be supplanted with isometric views automatically developed at the design stage.

Integrated orthographic-isometric projection merits consideration in high school and college graphic instruction. With this automatic system, the student need no longer struggle to "visualize"—he can see the three-dimensional picture in direct projection with the orthographic views, all developing simultaneously.

#### The Author

WAYNE L. SHICK is Associate Professor of Graphics Engineering, University of Illinois, Urbana, Ill. The article is based on a paper he presented at the Seminar On Cost Reduction in the Design and Drafting Rooms, held at the University of Illinois, on April 9, 1959.

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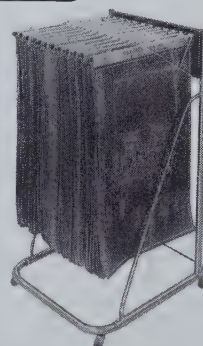
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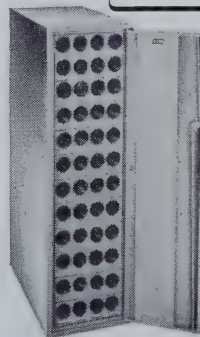
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# A GRAPHICS INFORMATION SHEET

*The drafting department of an electrical equipment producer finds that a simple reproducible form, a freehand sketch, and notes permit custom design of new orders from standard parts*

**A** VERY SIMPLE FORM is being used to eliminate endless re-tracings and revision of standard engineering drawings at I-T-E Circuit Breaker Company in Philadelphia.

The form—draftsmen there call it an “information sheet”—consists of a simple freehand sketch of the custom unit to be made, with notes to identify the necessary drawings of the standard components and panels. On it are also noted the deviations from standard for each component or panel.

The information sheet is essentially an 8½" by 11" sheet of tracing paper with title blocks which can be reproduced on the firm's diazo equipment. The form would be applicable to any company faced with design problems comparable to those handled by I-T-E.

I-T-E is a leading producer of equipment for the control and transmission of electrical power, manufacturing circuit breakers, switchgear, transformers, rectifiers, power switching equipment, panel boards, insulators, metal-enclosed and distribution busses—for residential, commercial, and utility markets.

This range of products and markets results in custom handling of more than 70 per cent of all their orders. Revising this array of drawings to meet customer's specifications would impose an impossible work load, they report. Each drawing would have to show the customer's special requirements, and it would soon become impossible to designate any one assembly as a standard. To eliminate this, I-T-E designed and instituted the information sheet and the procedures outlined below.

## FOR INSTANCE

**A**S AN EXAMPLE of the way these operate, consider a recent order

for 5 KV metal-clad switchgear; this equipment gives centralized electrical protection and control of incoming power lines for a plant. It is designed in standard frames and panels so that future additions will match and line up. Typically the equipment includes circuit breakers, relays, meters, instruments, instrument transformers, and other devices.

The circuitry and sub-assemblies are especially designed to meet the customer's requirements. For all practical purposes, the finished switchgear will be custom designed from standard components, for which engineering drawings exist. These drawings, when called for by the requirements of the job, will be reproduced on diazo equipment, the whiteprints then are used in manufacture.

Once the customer's particular requirements are determined, a free-

hand sketch is made of the equipment with notes showing changes and drawings; all this goes on the information sheet. In the case cited, a panel is to have a standard punch, to be located in a special area shown within the sketch. The print number of these standard punch is given as a note, and the center line location noted on the sketch. The required number of copies of the information sheet plus the same number of the necessary standard engineering drawing prints are reproduced by diazo, then sent to the manufacturing area with the shop order. When the unit is complete, the information sheet is returned to the customer file where it is retained as a reference record.

By the use of this simple expedient, the many combinations of components, circuits and panels can be quickly combined into a custom-designed unit.



PROCESSING standard prints used with information sheet in shop to make custom unit.



# Operations and Procedures for Engineering and Drafting Supervisors

*The key figure in inspiring high achievement and maximum performance from engineers and draftsmen or designers is the immediate supervisor. His attitude can either stimulate or stifle potential creativity. What specific characteristics and working attitudes should he possess?*

By George C. Schmidt

**T**HERE IS AN increasing demand for more men to hold down leadership positions and a further demand for present leaders to increase their skill.

Many people tend to be self-conscious about thinking of themselves as "leaders." The term seems to imply a whole galaxy of heroic qualities that they rarely associate with themselves.

Yet leadership can be defined as *the process by which the activities of a group are directed towards some common goal.* And when leadership is defined in this way, it becomes clear that there are many leaders in any large business. Vice presidents, superintendents, managers, supervisors, foremen—in fact, anyone who directs the activities of a group of people, however small—is a leader or supervisor by this definition.

stantly growing in their jobs. They are not necessarily looking for a better position, but are seeking to qualify themselves for one which will seek them out. Other men never develop their job beyond the point at which they assumed it, and they seem to be incapable of taking hold when additional responsibilities are thrust upon them. These latter will eventually find themselves removed or back in the rank and file—and sometimes they become resentful and wonder why this had to happen.

Depending upon the initiative and capabilities of the man in the job, the job can increase in importance—or it can be reduced to a point of elimination by management.

## THE SUPERVISOR AS A PART OF MANAGEMENT

**E**VERY SUPERVISOR, from the foreman level up, is a part of management. Some men who have been advanced from the ranks find it difficult to accustom themselves to this idea, and it must be confessed that top management does not always adequately impress it upon them. But nothing is more important to the supervisor's success than to keep this fact constantly in mind; every problem and every act must be considered and, more important, every decision reached only after due consideration from the "management point of view."

Management has two meanings:

the "who" meaning and the "how" meaning. Management is both people and practices.

First, it means the group of people who establish or carry out the policies of the company—the formal group—as distinguished from the rank and file of employees. The supervisor, as a part of this group, definitely shares a responsibility for the company's profit or loss as well as for the livelihood and well-being of those under his supervision. Although only top management makes policies, all management—and this includes supervision—carries them out. Obviously, the supervisor must make it his business not only to know company policies but to understand them as they affect his job.

Second, management means a way of getting things done. Therefore, when a man, by becoming a supervisor, enters the ranks of management, his efforts are no longer directed toward doing things himself, but toward getting things done by others—preparing, organizing and directing human effort. He is no longer working directly with instruments and materials, but with people.

This matter of "human relations" is of overwhelming importance to the supervisor. A man is usually advanced to the position of supervisor because he knows, and knows well, the technical part of his job. But whether he will remain a supervisor depends on how well he handles the men under

Editor's Note: This article, Parts I and II of which are presented herewith, is based on a paper delivered by the author at the Engineering and Drafting Management Institute, held at the University of Wisconsin, October 8-9, 1959. Parts III, IV, V and VI will appear in coming issues.



him. As a craftsman, he was working for somebody; as a supervisor he must work with everybody.

The supervisor also has a definite responsibility of carrying out on his level the policies of top management—policies which he may have had little or no part in making and the particular reasons for which he does not always completely understand.

The basic policies of the company and the procedures which put them into effect have been determined by top management as those best fitted to advance the interests of the company. It would be extremely unbusinesslike as well as destructive of the best interests of the company to appoint to a position of responsibility anyone who does not have faith in these policies or who would be inclined to oppose them, either actively by going contrary to them, or passively by simply ignoring them.

This principle of business conduct has no relation to a man's ability or to his loyalty to the company. It simply means that when a supervisor cannot give his whole-hearted cooperation in the carrying out of a program of which his responsibilities are a part, it is only businesslike that he should be relieved of those responsibilities and placed in a position where his abilities can be used to best advantage and his personal feelings will not interfere with the company program.

#### THE SUPERVISOR AS A "LEADER"

THE emphasis on "working with people" brings us to the second element in the requisites for the supervisor's job—that he must be a leader. Even though the supervisor knows all about the work for which he is responsible and has acquired the management view in thinking about it, unless he can win the confidence and cooperation of those who report to him he will never succeed in his job.

The supervisor must not only know what to tell his men to do, but he must know how to tell them what to do. He must be able to tell them in such a way that they will want to do the job right. The supervisor must be able to handle men so they will be "for him"—so that, in an emergency, when something can be accomplished only if everyone does more than would normally be expected of him, the men will take pride in their ability to surmount the unexpected obstacle "in stride."

What makes this leadership element doubly important is not only that the supervisor must accomplish his work through people, but he is usually the only man in the management line of responsibility who has direct executive authority over the worker who, in the final analysis, really gets the job done.

In the everyday accomplishment of a job of engineering or production policy, every instruction and every request of top management must sooner or later channel through the supervisor, and only through the supervisor can top management be made aware of the action and the attitudes of their employees. Top management must always fall back on the supervisor in the control of any problem involving the human element—such as the reasons for an excessive labor turnover, for delays, increases in costs, for waste or for poor worker attitude.

To be a better leader, a supervisor must make it his business to learn about people—why they act or react as they do, to what will they best respond. He must know how to put a man at ease; how to "tell a man off" without creating antagonism; how and when to praise and how and when to blame so that every worker under his direction becomes a member of his team and knows his position on it.

#### THE SUPERVISOR'S JOB-OPERATIONS KNOWLEDGE

WHEN AN ORGANIZATION has passed the stage of a small company run by the owner and employing just a few men, definite systems of organization and control are necessary. The compiling and spreading of information to those who do not come in direct contact with the work will be done through records and reports; and these will inevitably show up a supervisor's efficiency or inefficiency. The supervisor is responsible for the amount and quality of work done and for getting it done on time and within the limits of the estimated cost.

1. *Mechanical and Technical Phases.* The supervisors job at the lower levels of supervision calls for a fairly high degree of familiarity with the mechanical and technical phases of the work; but as he moves higher on the scale, this knowledge will become more general and less special. Whereas the foreman or group leader should be personally qualified to do

any of the work that he would expect his men to do, the same is not true of the chief who need not be an expert on all or even any of the jobs under his jurisdiction. But the supervisor who thinks he can limit himself to "paper work" runs two risks—first, that he will miss many of the little things that add up to inefficiency and, second, that he will lose the respect of his men.

2. *Quality and Waste Control.* What the supervisor knows about the work he is supervising will enable him to control waste. Excessive waste, especially of time, will stand out on any supervisor's record like a sore thumb, and management will not tolerate it for long. The only way the supervisor can control waste is to know either personally or through his subordinates how the work should be done, and see that it is done that way.

Waste develops or costs increase when quality or quantity is diminished and the time spent in doing something is increased. There are times when the company has learned to expect such situations, but rarely are they completely beyond the control of supervision.

3. *Planning and Scheduling.* As the work on a project develops, as it will immediately after the preliminary planning is complete, forces will increase rapidly and the subordinates will have to have a clear idea of what is to be done, how it is to be done, and when it is to be done. To provide the proper direction is the real test of the quality of supervision.

When the worker knows what to do, when to do it, and how to do it, there is a sort of automatic control over quality and the supervisor does not have to be a trouble-shooter with all of his time taken up with one small crisis after another. Most men want to do good work for the supervisor who is able to stimulate their interest and pride in their work. It is the duty of the supervisor to bring about such an atmosphere. Confusion breeds waste and discontent. Planning eliminates confusion. The good supervisor is a good planner.

Scheduling is done so that work will progress smoothly and on time. Even when the supervisor does not actually prepare the schedule himself, he will always have some contribution to make to its preparation. He does have a definite responsibility in any case for making it work out as it



should. Therefore, it will pay him to familiarize himself with modern planning and scheduling methods.

4. *Methods Improvement.* The supervisor should have a knowledge of *methods improvement* and *work simplification* which eliminates waste of time, effort and material.

Again, although the supervisor may not do any of the actual study which results in work simplification and improved practices, he will be constantly called upon for information and advice. Time is the largest single element of cost within the supervisor's direct control.

5. *Cost Control.* In the final analysis, all the efforts of the supervisor are directed toward the production of good quality work, on time, with lowest unit costs. Top management is always looking at costs, and to keep track of costs has usually set up a formal system of cost control.

Too much stress cannot be laid on the importance of cost records and the fact that they must be as accurate as it is humanly possible to make them. The very human tendency to "fudge" a little in reporting costs so as to make things look a little better can be absolutely fatal in that it defeats the entire purpose of costs records and misleads management.

Different kinds of cost records or reports are made available to different levels of supervision. When top management provides a supervisor with these records it does not do so just to build up circulation. The supervisor is expected to subject them to careful study so as to discover what usable information he can get from them on costs which come within his control.

The supervisor who is aware of the "growth" element in his job will be particularly interested in cost control methods because they must inevitably play a more extensive and important part in the next job to which he will be advanced.

The good supervisor will do his best to understand in a general way the how and why of the company's cost reporting system for another and very important reason. If a meeting is called to discuss or interpret a cost report, the supervisor may be asked to attend. In such a case, he will want to be able to talk intelligently about his own operations.

As has been said, people are the instruments with which the supervisor works. He is therefore called upon to

assume certain direct responsibilities for those under his supervision.

#### PERSONNEL RESPONSIBILITIES

**S**AFETY; the prevention of accidents is one of the most important parts of the supervisor's job. Every accident is preventable—even if the prevention of a recurrence calls for the major reorganization of a method. Management can go a long way in emphasizing the importance of safety by distributing literature, putting up posters, holding safety meetings and

the like, but day by day the responsibility for seeing that workers do not get hurt fall directly on the shoulders of the supervisor. He must not only know the fundamental principles of safety, but he must be constantly on the alert for hazards. Above all, he must make no compromises in his toughness in the enforcement of safety rules.

2. *Maintaining Satisfactory Working Conditions.* The second direct personnel responsibility of the supervisor is *maintaining satisfactory working conditions*. Notice that we say "main-

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taining." Companies seek to provide a high standard of working conditions. The supervisor maintains this standard by good housekeeping.

3. *In Personal Relations.* There is one phase of working conditions of which the supervisor will have an intimate knowledge and top management will have little or none at all, and that is the emotional stability of the worker. This can be as important as his physical condition.

To accomplish anything as a team, men must get along well together. To see that they do, the supervisor must get to the root of any trouble. This is a part of his responsibilities as a leader. His men must feel free to turn to him in their difficulties with the expectation of getting a sympathetic hearing and such help as the supervisor is in a position to give.

Some men get along better in association with certain men than with others and on one job than on another. It is the responsibility of the supervisor to assign men where they will work best and do best.

While the company has no direct responsibility for the personal troubles or difficulties of its employees, it cannot afford to ignore them when they are affecting the job that has to be done. A progressive company has the interest of its employees at heart and will, within reason, do all it can to help them. The supervisor should know the person or department to help the employee.

4. *Training.* In any organization, the supervisor has some responsibility for training. Men are hired for the skills they already possess. Training may consist of directing these general skills to the particular needs of the job at hand.

#### COOPERATIVE PERSONNEL RESPONSIBILITIES

THE TERM "job evaluation," as used here, does not refer to the evaluation of work that has been done, but of work that is to be done: duties to be performed, responsibilities called for, skills required, time to be allotted, etc.

Job evaluation is used in manufacturing industries to guide fair wage administration, but this is not usually a problem of the supervisor of drafting or engineering.

There are, however, a number of situations in which the supervisor must size up a job and pass on his

conclusions concerning it to others. The decisions he reaches should be sound ones.

#### WORK EVALUATION

MERIT RATING is the evaluation of work. This responsibility is usually that of higher level of supervision, and it is assumed that if you are not already at that level you will eventually reach a level where you will be called upon to rate a man, or rate a group of men so that one or more can be selected for special assignment, increase in salary, promotion, etc.

#### SUPERVISORY EXPERIENCE

THE SUPERVISOR is constantly accumulating supervisory experience which is invaluable to his company and of which the company will want to take full advantage. The conscientious supervisor will want to broaden his experience by following up on new ideas, by learning beyond his immediate job, by extending himself mentally. As soon as he stops this, he and his job stop growing.

A company is always on the lookout for new ideas and many of them will come from supervisors qualified by an ever-growing experience to appreciate their value.

#### ECONOMIC KNOWLEDGE

THE AMBITIOUS SUPERVISOR will seek to equip himself with a sound economic background. When we speak of economic knowledge as a requirement for good supervision it may seem that we are going far afield, but such is not the case. The problems of any company are not theirs alone. The company fits into the industry as a whole, and both company and industry are subject to economic forces beyond the control of individuals or small groups. The supervisor who has acquired a knowledge of the elements of economics will have a better understanding of the problems of wages, hours, profits, investments and the like and will see how all these are intimately tied together and how no element of the economic system can be tampered with without having an effect on all the others.

The supervisor who does not have at least an elementary knowledge of the economic structure is forced to carry out orders blindly.

It has been pointed out that the

supervisor is a leader. His men reasonably assume that he got where he is because of what he knows and they will defer to his ideas and opinions even on matters which are not related to the job. These ideas and opinions should be sound ones if the supervisor is going to keep the respect of his men—and they will attribute ignorance to him if he tries to dodge the issue. He should be able to discuss national issues quietly and not argue heatedly. In every large working group there is bound to be a quota of cranks who will be attracted to current "isms." These cranks can get out of hand and become troublesome and waste a great deal of time by provoking time-wasting discussions. They can be counteracted only by sound information.

There is, therefore, good reason to suggest to the supervisor the value of basic information about economics.

#### LABOR-MANAGEMENT EXPERIENCE

THE SUPERVISOR must be well informed on labor-management matters as they apply to his department so that he can understand and appreciate the reasons behind various industrial organizations and the difference between staff and line functions. With this knowledge the supervisor can recognize the logic behind company decisions and be able to cooperate more fully.

From the labor standpoint, the supervisor must be well-informed about jurisdiction, legislation relating to labor and the like. It is a firm policy of a good company to abide scrupulously by all its obligations, whether represented by contracts, by agreements with labor through their duly elected representatives, or by the laws of our land. The supervisor may, through ignorance, unfairly place the company in the position of violating an obligation. After all, to those under him the supervisor represents the company. Decisions in labor matters should not be made lightly, and they should not be made at all without full knowledge of the facts.

#### II. LEADERSHIP AND ITS RESPONSIBILITIES

SOME men are natural-born leaders—but they are the exception rather than the rule. Some natural-born leaders do not even realize their potential until they are up against an unusual situation which compels them





*"... and this is our drafting department, General!"*



to draw upon resources they did not even know they had. But such a testing—the perfect combination of the time, the place, the situation and the man—is not likely to come to many of us. Most of us are not born leaders. If we want to lead, we must develop the art of leadership, and it can be done.

We hear people say of a supervisor, "He sure is a great guy to work for." They are describing a leader. For him they will go out of their way to do things, not only carrying out instructions cheerfully and well, but adding a plus value, something that would not be in the strictest sense required of them. These men do what they do because they feel themselves to be part of a team with their own contribution understood and appreciated.

We know this is not something that "just happens." It is something that is built up on a man-to-man relationship. It grows out of a man's feelings for his job, his boss, and his company. This attitude is the most valuable asset a company can have and is the result of real leadership.

Such high morale is based on three simple feelings of the worker: I like my work. This is a good company to work for. The boss understands me, appreciates my efforts and will give me a square deal.

Where such feelings exist, the worker will want to do his best all the time. It is the duty of the supervisor to see that the worker has these feelings.

Leadership is the art of dealing with people so they will work willingly and well through your influence and example, and the ability to touch the traits that will move them to put forth their best efforts. You can accomplish this only if you like people and enjoy seeing them get ahead under your guidance and direction. In all your relations with the men you must be straightforward; you must be fair; you must have the moral courage to stick to what you believe to be right and just; you must be human; and you must have a sense of humor.

The supervisor has to be realistic and take things as they are with a minimum of "ifs" and "buts". He must take people as they are, enlisting their interest, cooperation and effort in a common cause. He must be tolerant of personal peculiarities and small shortcomings.

#### WHAT THE COMPANY EXPECTS OF THE SUPERVISOR

**T**HERE ARE five major and immediate duties of the supervisor which call for leadership:

Maintaining standards of quality.

Getting the work out on schedule.

Improving methods.

Keeping costs down.

Dealing with personnel problems.

Everything that the supervisor does in the course of his day's work may be fitted into these five duties, and practically every situation he will have to deal with will call for leadership if he is to get real results. If the supervisor is really anxious to get the kind of results which come from the interest, enthusiasm and cooperation of the men he directs, one of the best ways to build up this attitude is through analyzing his own duties and responsibilities. Obviously, to be an effective leader, he must know his own job. Then, the supervisor must be clear on company policy. Otherwise, situations are bound to arise which will reflect on his reputation for leadership.

#### WHAT THE WORKER EXPECTS OF THE SUPERVISOR

**T**HE SUPERVISOR who asks himself, "What do my men expect of me?" can arrive at an answer without any crystal-gazing. The men expect from the supervisor exactly the same kind of treatment that the supervisor expects from his own superiors. The impression which the worker forms of the company—whether or not he thinks it is a good company to work for, and whether or not he is interested in doing his job well—is based almost entirely on the way he is handled by his immediate superior. All the supervisor has to learn about what his men expect of him is to put himself in their place and, approaching the subject from that angle, agree that the following twelve points are fair statements. (1) The supervisor must know his job. (2) His treatment of his men must be courteous. (3) His treatment of his men must be consistent. (4) His treatment of his men must be fair. (5) He must show no favoritism. (6) He must see that his men have the necessary supplies, materials and instructions to do a good job. (7) He will grant his men the opportunity to talk things over freely and will listen to them with courtesy and respect. (8) He will

make every effort to understand their side of a problem. (9) He will handle their grievances promptly. (10) When presenting their views to his superiors, he will do so adequately and fairly. (11) He will let the worker know where he stands, and will give recognition for a job well done. (12) He will respect each worker as an individual who is making a contribution to the success of the job.

#### KNOW THE JOB

**A** MAN may not be liked personally, but if he knows his job we are forced to respect him. A supervisor must have the respect of his men, and only by knowing his job can he gain and hold respect and confidence.

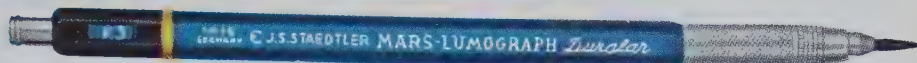
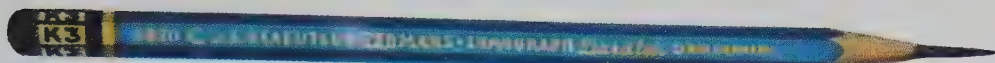
But there is another angle about knowing the job. Only if the supervisor really knows his job can he plan his work well, see that the proper equipment and materials are available, see that the equipment is in good order, and anticipate troubles. He does not wait until trouble occurs before he does something about it, for he is very much concerned with preventing bad situations from developing. He is always on the alert to note changes which may affect his production, costs, quality, and the attitude of his men.

#### BE COURTEOUS

**C**OURTESY promotes good will. It saves time and wear and tear on the nerves. The supervisor of whom the workers say, "He is a funny guy; you never know how to take him," is a liability to any company. We are all familiar with the type. He seldom has anything to say to his men except to bawl them out. The man who greets him gets only a grunt in return. He is not consistent in his treatment of men or in his handling of situations, and no one is ever sure what his reaction is going to be. The result is that the job suffers because people avoid consulting him. They simply do not like to do business with him. Now, we all have our "off" days, but whether the going is rough or smooth there is only one course open to the supervisor. He must keep his head in a trying situation and always be courteous to his men. Otherwise his effectiveness as a leader will diminish or be lost entirely.

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exaggerated etiquette suited to social events. What we are talking about is the consideration to which the personal pride of every man is entitled.

#### SUPPLY INFORMATION

**I**NFORMATION and material where you want them when you want them are necessary to get a job done. Most people want to do a good job. The circumstances that will prevent them from doing it may usually be blamed upon the supervisor. Management—and this includes the supervisor—has a definite responsibility for seeing that the work is properly planned, the man on the job has been given the necessary instructions, and that the necessary materials and equipment are available to the worker. To put it briefly: the supervisor must see that all the conditions necessary for efficient operations are provided for and maintained.

#### FAIR PLAY

**F**AIR PLAY is a must. One of the surest ways to create dissatisfaction and ill-will is to show favoritism. Like situations call for like treatment

—and this is not always easy. Remember that everything you say and everything you do is a subject for job “scuttlebutt,” to be picked up and picked apart. The areas calling for special alertness in this respect are:

Letting some men get away with what is contrary to rules and then disciplining others for the same violations.

Assigning work on a basis other than the man's ability to do the job well.

Letting personal feelings, rather than fitness, ability and service, determine your recommendations for transfers or promotions.

Ignoring the pride of the individual and making him lose face with his fellow-workers by public blame, ridicule or sarcasm.

Indicating a lack of tolerance in your personal feelings toward any group or any individual.

#### GOOD LISTENING

**W**HEN SUBORDINATES want to talk things over with you, there are three reasons. You have their confidence. They feel you will try to understand their point of view or their

problem. They value your advice and your judgment.

However, when men do come to you, try not to give the impression that you “know all the answers.” Discuss the subject within reason and try to get the man to find the right answer himself by having him weigh all the facts. Be approachable. Listen attentively to his problem. Suggest various alternatives to him. In other words, try to help him to think the situation through until the answer is clear.

#### HANDLING COMPLAINTS

**I**T IS IN the prompt and intelligent handling of complaints that the best qualities of the supervisor are likely to be shown.

A complaint is *anything* which adversely affects the attitude of a worker toward his job, his superior, and his company.

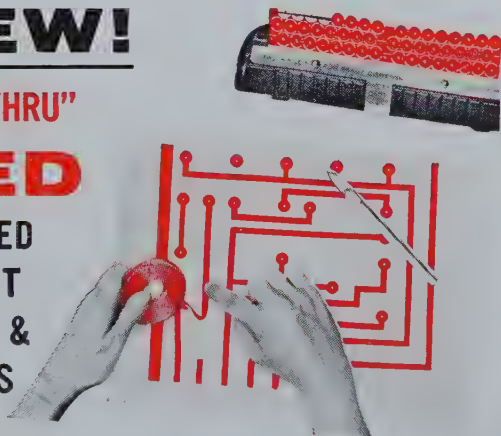
Never forget that every complaint is real even if the cause is imaginary, and the cause may arise outside the job as well as on it. Whatever the true cause, the fact remains that the output of the work and its quality will both suffer unless the situation is cleared up. The handling of com-

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complaints is the responsibility of the supervisor, and the way in which he handles them will make or break him—will either build up or lessen confidence in the “boss” and good will toward the company.

It is not, of course, the responsibility of the supervisor to attempt to settle or arbitrate matters which are in the province of agreements between managements and the representatives of workers. Major complaints should be referred to the proper officials.

#### WORKER PERFORMANCE

EVERY worker has the right to know just “where he stands” and how he is doing. This does not mean that he is always expecting a pat on the back, but it does mean that he has the right to know when he is not making

the grade. A supervisor who has the confidence of his men can give any one of them helpful criticism and point out his weak points without antagonizing him. That man will be grateful and will try to strengthen those weak points and everything will work out better all around.

#### BACKING UP YOUR MEN

A GOOD LEADER always looks out for his men and, when the situation justifies it, they have the right to expect that he will take their case “all the way to the top” to get action on a major problem. They feel that their immediate superior should be able to stand on his two feet and speak up for them when their cause is a just one, presenting a factual picture of their case and arguing it earnestly and well.

#### RECOGNITION OF GOOD PERFORMANCE

WHEN A MAN has done something that calls for recognition, give it to him. This is an unusual opportunity to build up morale and strengthen good will. It takes only a little of your time to single out the man and thank him personally. If possible, bring his accomplishment to the attention of others. The “higher-ups” will, as a matter of company policy, inform him that you have brought him and his contribution to their attention.

#### The Author

GEORGE C. SCHMIDT is Chief Draftsman, Campbell Soup Company, Camden 1, New Jersey.

## Recruiting and Training Draftsmen

(Continued from page 16)

potential and worthy of more intensive training.

It should be emphasized that management in our firm strives for and stresses the importance of versatility in its employees. The men selected to attend these detail courses dealing with the various phases of the work were not necessarily those actively involved in that particular phase of the work. For example, a man regularly involved in the preparation of physical electrical construction drawings could well be chosen to attend classes in electrical circuiting. The possibility of interchangeability of the men among the various jobs, when the needs arise, is a valuable asset to any firm.

Samples of the detail courses provided are as follows:

- Electrical Circuiting: The primary purpose of this course was to instruct the men sufficiently in electrical fundamentals to allow them to design and check out construction wiring diagrams from engineering schematics.
- Electrical Physical Layout: This course was organized to familiarize the men with the methods and procedures used to produce

the actual electrical construction drawings.

- Structural Design: A course was arranged in the structural drafting room to acquaint the younger draftsmen with the various details of masonry and steel design.

All of the previously described courses are provided by and delivered within the organization. They are conducted by regularly employed qualified company personnel. Sargent & Lundy also has selected certain individuals to attend intensive special-

ized courses outside of the organization. Such courses may last from several days to several months. Tuition and other costs are paid for by the firm.

#### The Author

L. E. TEPPER is Chief Electrical Draftsman at Sargent & Lundy, Consulting Engineers, Chicago, Illinois. This article was first presented in somewhat different form at the 1959 annual meeting of the Technical Drawing Associates.



### WEBER CELLULOSE ACETATE DRAWING INK

A special Weber Black Waterproof Drawing Ink for use on cellulose and matted acetate foil and sheeting. For drawing on all high surface finishes such as on photographs, ozalids and films. A must for water-repellent tracing cloth. In 1-oz., 16-oz., and 32-oz. bottles.

Write for prices and trade discounts.

**F. WEBER CO.**  
ARTIST AND DRAWING MATERIALS  
PHILADELPHIA 23, PA.





# Graphic Perspective

by Eleanor W. Thompson

**T**HE ENGINEERING or architectural draftsman, carefully lettering notes and dimensions on his drawing, whether free-hand or by means of a mechanical device, may not be aware of his link with the long line of scribes—for the most part anonymous—who have preceded him. But link there is!

The scribes we refer to are those misty figures of history, laboring to establish the designs of Egyptian hieroglyphics, the skilled Roman artisans laying out inscriptions for stone carvers to follow, and the cassocked monks hidden away in some medieval monastery, lovingly producing the beautiful illuminated manuscripts which have preserved for us much of the knowledge that otherwise might have been lost when the Dark Ages settled over the Western World.

One may ask what connection there is between a cassocked monk and a twentieth century draftsman. It is this writer's opinion that the word draftsman (whether spelled "drafts" or "draughts") should not be limited to an individual or the type of work usually associated with the T-square and triangle. Surely the draftsman's skill is more universal than this!

A careful analysis of a fine old painting, for instance, will reveal that underlying the brushwork and color

is a firm foundation of disciplined drawing or *draftsmanship*. The same is true in work of the calligrapher, especially in such examples as may be found carved in the pedestal of Trajan's column in Rome, or hand-lettered by reed or quill pen in illuminated manuscripts of medieval times; the famous Book of Kells—considered by many experts to be the most handsome manuscript book ever written—is an outstanding instance of this.

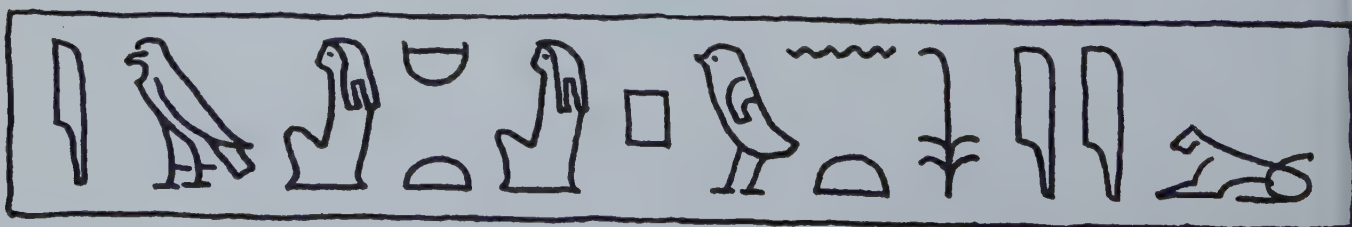
A study of the historical development of lettering, culminating in our present twenty-six letter alphabet, is rewarding in many respects. The student will find much of interest as he follows the path from Egyptian hieroglyphics, carved in stone, wood or plaster, the later hieratic script written with reed pen on papyrus, the Greek letters scratched on wax tablets with pointed stylus, and on through the many forms of letters written with reed or quill pens on parchment or paper during the long dark period following the collapse of the Roman Empire.

Books can and have been written on this fascinating subject. However, from our "perspective" point of view, one aspect of all this work attracts our attention—the skilled draftsmanship employed in the drawing of these letters. It is clear, for instance, when

one examines the remaining examples of Roman inscriptions, that here is more than a fine example of the stone carvers' work. It was really the drawing, guiding the stone cutter, that determined the form of these beautiful letters. The fanciful intricacies of the colored initials of the Book of Kells while attesting to the artistic skill and patient devotion of the seventh century monks in the monastery at Kells in County Meath, Ireland, likewise attest to their disciplined drawing skill. Unquestionably, art was being served in the creation of these letters—and draftsmanship was a vital part of this art.

That same skill continued to manifest itself through the centuries until the middle of the 1400's when printing with moveable type took over the work of the scribes. Prior to this, during the thirteenth and fourteenth centuries, the so-called "Gothic" letter had developed and was in widespread use throughout northern Europe, having driven out most other styles of lettering.

It is this Gothic letter, in varying forms, which most of us associate with the traditional Christmas season. In the spirit of Christmas, therefore, we have incorporated on our cover a Yuletide message, employing one of these styles of letter.





# GRAPHIC SCIENCE SUBSCRIPTION APPLICATION FORM

(To be filled out and returned, if you haven't done so yet.)

## GRAPHIC SCIENCE IS FOR SOME—NOT ALL

IN ORDER to receive subsequent copies of GRAPHIC SCIENCE, the Questionnaire below must be completed and returned to: Editor, GRAPHIC SCIENCE, 103 Park Avenue, New York 17, New York. A facsimile can be filled out and mailed if you would like to keep this issue intact. All Questionnaires will be acknowledged.

Your free subscription to GRAPHIC SCIENCE will be continued if your job involves: (1) The supervision of draftsmen or a drafting department. (2) Supervision of reproduction or drawing-filing personnel or departments. (3) Supervision of technical

illustrators or technical photographers. (4) Teaching of engineering drawing or graphics. If you do not qualify and wish to receive GRAPHIC SCIENCE, the subscription rate is \$8.00 per year in the United States, \$9.00 per year to Canada; \$10.00 to other countries.

Your free subscription will be discontinued if the questions below are not answered. The information you supply here will never be divulged. In coming issues, however, we will summarize the data received, reporting results for your own information.

May we hear from you shortly?

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

Address: Street \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Company product or function: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Your job function: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Number of personnel in your department:

\_\_\_\_\_ Draftsmen \_\_\_\_\_ Reproduction

\_\_\_\_\_ Designers \_\_\_\_\_ Checkers

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I've been working in my present job for \_\_\_\_\_ years.

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\_\_\_\_\_ I'm qualified to receive GRAPHIC SCIENCE free.  
Continue my subscription.

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SCIENCE free, but I'd like to subscribe.

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There are other personnel in my firm who should receive GRAPHIC SCIENCE. Their names, titles, and addresses are as follows:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(You may attach a second sheet, if the space here is not adequate. Extra Questionnaires are also available on request.)

Comments? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

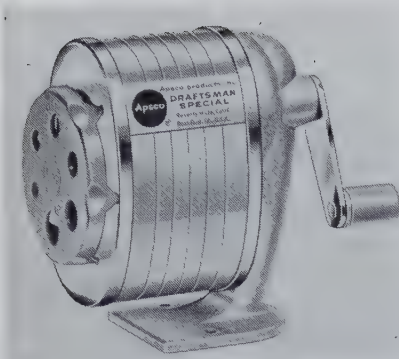
I'm interested in writing for GRAPHIC SCIENCE:

\_\_\_\_\_ Yes \_\_\_\_\_ No

Signed \_\_\_\_\_



# New Products



## Special Pencil Sharpener

A pencil sharpener which removes the wood only, exposing  $\frac{3}{8}$  inch of blunt lead for shaping, is said to be well suited for use in drafting rooms and engineering classes. Called the Draftsman Special, the unit is manufactured by APSCO Products, Inc., P.O. Box 840, Beverly Hills, Calif. It is designed as an inexpensive unit, equal in quality to the APSCO regular pencil sharpener.

## Tiny Microfilm Reader

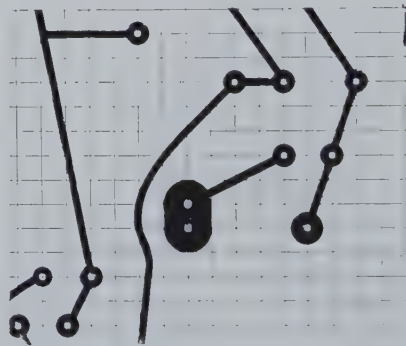
This three-ounce reader, with a double-lens system, is said to give a sharp image of the full microfilm frame at a three-times magnification. Called Inspector "25", the reader is produced by The Filmsort Co., (Division of Minnesota Mining & Mfg. Co.), Pearl River, N. Y. The pocket-sized reader has a plastics card holder for positioning the military "D" aperture card. It is designed for reading microfilmed engineering drawings from 8½- by 11-inches to 18- by 24-inches in size.

## Copying Machines

Desk-top copy makers, utilizing the semi-moist diazo process, have been announced by Coperation, Inc., 5650 N. Western Ave., Chicago 45, Ill. Called Dart, the units are said to produce any number of copies from the same original for a material cost of less than one cent per letter-size page. Available in 13- and 18-inch widths, Dart copy makers also include a second lamp for exposing standard photocopy papers.

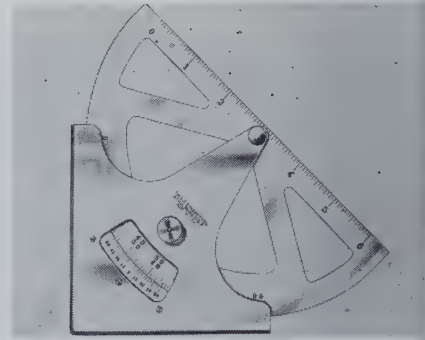
## Tracing Film

Improved tracing film for architectural drawings, engineering tracing, map reproductions and type-on masters for whiteprint or offset reproduction, has been announced by Ozalid Division, General Aniline and Film Corp., 32 Corliss Lane, Johnson City, N. Y. Called Duratrace, the material consists of a waterproof surface on an 0.002-inch Mylar base. It is said to have good dimensional stability and to provide fast reprinting speeds. Its tear and fold strength reportedly is superior to that of tracing cloth or paper; it will not reproduce woven cloth pattern or bruises and creases. It may be used to combine Polaroid transparencies with typed material for illustrated specification sheets. According to the manufacturer, its surface is suitable for pencils up to 5H and its erasing qualities are equal to those of the finest tracing cloth. It will accept pre-printed title blocks or other information.



## Printed Circuit Tape

Self-sticking red plastics tape, pre-cut to individual shapes, is now available for printed circuit layouts. Designated as Brady B-225 See-Thru Red, the tapes and shapes are being produced by W. H. Brady Co., 727 W. Glendale Ave., Milwaukee 9, Wis. The pressure-sensitive tape is translucent, allowing draftsmen to obtain close tolerance layout (plus or minus 0.005 inches) over backlighted master grids. The red tape photographs jet black. It is said to adhere firmly to Mylar, vellum, glass and acetate layout sheets; it can reportedly be reapplied without erasing or retouching. More than 150 standard shapes are made.



## Draftsman's Protractor

A recently introduced protractor has a vernier scale for precision settings to 5 minutes of arc, or one-twelfth of a degree. The No. 361 Draftsman's Protractor, designed and manufactured by L. S. Starrett Co., Athol, Mass., is said to lie perfectly flat on the drawing board and to lock at any desired setting by means of a single knurled binding nut, which also serves as a knob for picking up the instrument. The protractor arc is graduated 90° and figured both ways to read from right or left. This protractor does not have to be reset to obtain the complement of any angle; a line marked off against the edge of the stock will automatically form the complement of the angle to which it is set.

## 105/35 mm. Camera-Projector

## Electrostatic Projector-Printer

What is reported to be the first combination 105/35 mm. camera-projector will be available soon from Keuffel and Esser Co., Hoboken, N. J. Identified as the Micro-Master, it can be shifted from camera to projection work in a matter of minutes by using interchangeable magazines. A projector-printer is also being made available by the firm. An electrostatic unit, the Kecofax will produce finished prints up to 34 by 48 inches from miniature negatives. Exposure and processing are automatic: a finished print is delivered in 40 seconds. Both units will be shown for the first time at the Visual Communications Congress December 3, 4 and 5.



# New Products

## Adjustable Drafting Curves

Adjustable curve drafting instruments, hand-calibrated to maintain a high degree of accuracy, are offered by Albert G. Daniels, 109 Chalmers St., Winnsboro, S. C. Developed primarily for highway drafting, these instruments are useful in other fields where accurate circular arcs of long radius are required in drafting work.

## Automatic Photocopier

One-step copying device, requiring no solution handling, makes copies up to 14 inches wide by any length in 19 seconds. Called the Cormac "500", the unit is produced by Cormac Photocopy Corp., 80 Fifth Ave., New York 11, N. Y. According to the manufacturer, the desk-top unit automatically exposes, develops and separates original from copy.



## Drafting Fountain Pen

One fountain pen holder with seven interchangeable point sections allows drawing, ruling and lettering in seven different line widths using a single instrument. Each point section has its own refillable, plastics ink cartridge. All parts are acid-resistant, permitting the use of all types of drawing, regular and acetate inks. Produced by Koh-I-Noor Pencil Co., Bloomsbury, N. J., the new Rapidograph Technical Fountain Pen (Model No. 3065) makes it possible for the draftsman who uses many different line widths to have a complete range—00, 0, 1, 2, 2½, 3 and 4—at a considerable saving. The set retails for eighteen dollars.

## Microfilm Processor

A desk-sized unit that develops, fixes, washes and dries 16-mm., 35-mm., and 70-mm. microfilm continuously and intermixed, without adjustment or special attachments, has been announced by Remington Rand, Div. of Sperry Rand Corp., 315 Park Avenue South, New York 10, N. Y. Called the Unipro Universal Film Processor, the equipment is said to process up to 100 feet of film in 29 minutes.

## Self-Sticking Tapes

An expanded line of self-sticking tapes for the engineer, draftsman, layout man and statistician has been announced by ACS Tapes, Inc., (formerly American Chart Service Inc.) 217 California St., Newton 58, Mass. This expanded line includes plant layout symbols, newspaper and advertising border tapes and special reference designs, pre-printed on tape. In addition, a selection of 15 colored, matte-surface tapes that are completely non-reflecting has been developed; they may be written on with pen, pencil or other standard marking device. These new tapes are available in seven standard widths: 1/32", 1/16", 1/8", 1/4", 1/2", 3/4" and 1"

## Chart Typewriter

A machine designed for complex chart material typing has been announced by Continental Office Machines, Inc., U. S. distributors of the typewriter. Made by SIEMAG Feinmechanische Werke GMBA in West Germany, the machine has a keyboard of normal uppercase alphabet and figures. In place of lower case letters, however, are 27 different chart symbols. All chart symbols are in shift position so that no shifting is required when either "chart-typing" or "regular typing". An attachment permits the typing of charts on any kind of chart paper, accurately scaled and aligned. With a carbon ribbon attachment, the material typed on this machine is said to be ready for offset printing production.

# STANPAT SOLVES THE GHOSTING PROBLEM

**NEW resin-base STANPAT  
ELIMINATES GHOSTING,  
offers better adhesion qualities  
on specific drafting papers!**

### THE PROBLEM

Some of our longtime customers first called our attention to the "ghosting" problem. Certain tracing papers contain an oil which could be leached out by the STANPAT adhesive (green back) causing a ghost.

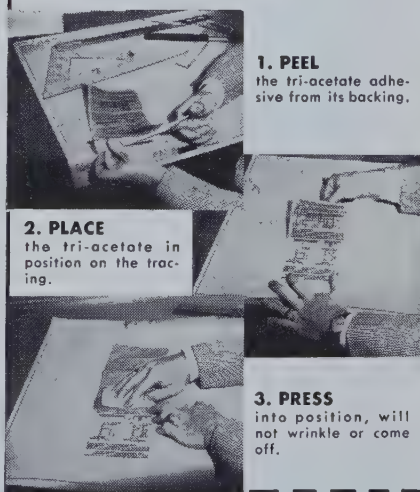
### THE SOLUTION

A new STANPAT was developed (red back), utilizing a resin base which did not disturb the oils and eliminates the ghost. However, for many specific drafting papers where there is no ghosting problem, the original (green back) STANPAT is still preferred.

### WHICH ONE IS BEST FOR YOU?

Send samples of your drawing paper and we will help you specify. Remember, STANPAT is the remarkable tri-acetate pre-printed with your standard and repetitive blueprint items—designed to save you hundreds of hours of expensive drafting time.

### SO SIMPLE TO USE



### STANPAT CO.

WHITESTONE 57, N. Y., Dept. 149  
Phone: FLushing 9-1693-1611

- ☐ Enclosed are samples of the drafting paper(s) I use (identify manufacturer). Please specify whether Rubber Base or Resin Base STANPAT is most compatible with these samples.
- ☐ Send literature and samples of STANPAT.
- ☐ Please quote price on our enclosed sketches which we are considering to have pre-printed.

NAME \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

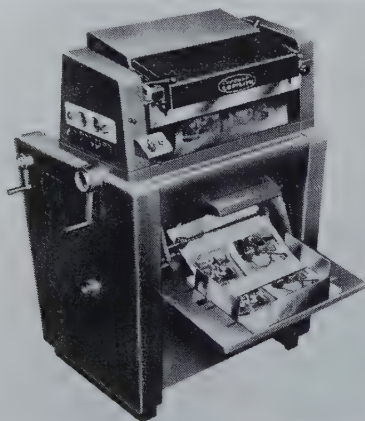
ZONE \_\_\_\_\_ STATE \_\_\_\_\_





## Tinted Diazo Film

Transparent, sensitized films with tinted backgrounds in four different colors for use in visual aids color projection have been announced by Ozalid Visual Aids, General Aniline and Film Corp., Johnson City, N. Y. Called Tinted Projecto Foils, they are intended for use with overhead 2¼- by 2¼-inch and 3¼- by 4-inch slides. The films are sensitized with black, dry-developing diazo coating on a 0.005-inch tinted acetate base. They produce black images on color-fast backgrounds in soft blue, green, yellow and pink. The continuous tone of the film maintains shading, adds interest to visual presentation and reduces glare.



## Photo Offset Press

A press for reproduction departments, that handles sheets up to 14 by 20 inches, with a printing area of 13 to 17 inches, at a speed of 5,000 impressions per hour, has been announced by Copease Corp., 425 Park Ave., New York 22, N. Y. Called Copease Copilith Senior, the press has built-in suction feed, positive grippers, puller-type side guides, adjustable stops for squaring the image on the paper, automatic cylinder pressure adjusters, cradle inking roller system to permit color change and push-button controls. The inking system is equipped with two form rolls and two brass oscillating rolls and can be furnished with either the patented Copifount system of combining dampening and ink in one system or with a separate water and ink system.

**Photocopying Machine Booklet**, (Form No. 20M 4-59 ES 103-1), presenting 115 uses for photocopying equipment, is available from F. G. Ludwig, Inc., 600 Coulter Pl., Old Saybrook, Conn. A number of uses pertinent to engineering departments and drafting rooms are included.

**Vertical Cameras Brochure**, entitled *The All New Kenro Line* and describing three new models suitable for most platemaking and photocopying requirements, may be obtained from Kenro Graphics, Inc., 25 Commerce St., Chatham, N. J. Specifications for each model are given and accessories are listed.

**Drawing Instruments Brochure**, entitled *Operation Craftsmanship II, The Story of Custom-finished Quality Imported Drawing Instruments*, may be requested from Gramercy Guild Group, 116 Broad St., New York 4, N. Y. The first section tells the story of Riefler drawing instruments and includes the material presented in a paper by Frank Oppenheimer, president of Gramercy Import Co., Inc., before a meeting of the American Society for Engineering Education at Seattle, Wash., in June 1950. The second section is a well illustrated catalog of a wide selection of drawing instruments manufactured for Gramercy Import Co., by various German craftsmen.

**Visual Communication Equipment and Materials**, a catalog (PL-2d 594 10M SP), is offered by Technifax Corp., 195 Appleton St., Holyoke, Mass. Certain diazotype films and materials, and a number of machines listed, are manufactured by Technifax; however, a selected line of complimentary equipment and materials produced by other companies and distributed by Technifax is also presented.

**Contact Printer Bulletin**, announcing the new Model PD301X 16 mm., 35 mm., and 70 mm. continuous roll contact printer, may be obtained from Photo Devices, Inc., 13 Canal St., Rochester 3, N. Y. Specifications of the variable-speed, dual-light-source unit are given.

**Microfilm Printer-Processor Brochure**, introducing a dry process copying system for printing and developing 16 mm. and 35 mm. roll duplicates in one operation, may be requested from Kalvar Corp., 909 S. Broad St., New Orleans, La. According to the manufacturer, no dark room, chemicals, vapors or venting are needed with the desk-top printer-processor, as Kalfax microfilm is exposed by light and developed by heat alone.

**Overhead Projection Textbook**, an 88-page hard-bound book, with color illustrations, has been compiled by the Audio Visual Department of Ozalid Div., General Aniline and Film Corp., Johnson City, N. Y. Prepared for use by industry, educational institutions and the military, the book covers application procedures and techniques of overhead projection. There are detailed presentations of the diazo and diffusion transfer processes. Tools, lettering, mounting and masking, basic art and layout principles, as well as special projection techniques are discussed. The book is distributed through Ozalid Audio Visual dealers.

**Annotated Computer Bibliography**, revised and updated, will prove of interest to engineers, educators and members of management teams whether their training in computers has been limited or extensive. This 54-page booklet is the third publication in the Univac Educational Series. In addition to the Introduction, the booklet has three sections: I. Theory and Operations; II. Applications: What Large Scale Computers Can Do; and III. General Background and Sources. Copy of this booklet can be obtained at Remington Rand branch offices, or by writing to the Company at 315 Park Avenue South, New York 10, N. Y. and requesting U 1806.

**Preparing Printed Circuits**, a brochure outlining four methods of preparing circuitry on film, by inking, taping, "cut'n strip" and scribing, is available from Keuffel & Esser Co., Adams and Third Streets, Hoboken, New Jersey. Step-by-step instructions with illustrations are included for each of the four methods.



# New Literature

**Printed Circuits Manual**, presenting a simplified technique for drawing printed circuits, is offered without obligation to engineers and draftsmen by W. H. Brady Co., 727 W. Glendale Ave., Milwaukee 9, Wis. Samples of Brady See-Thru Red Tapes and Shapes (Bulletin 163) are also available without charge.

**Ruling Pens Brochure** (Form 8189-5M) describing Marathon Long Line and Wide Line ruling pens is available on request from Keuffel & Esser Co., Adams and Third Sts., Hoboken, N. J. Filling, cleaning and sharpening instructions are given and design characteristics said to permit up to 45 feet of line-per-filling are illustrated.

**Adjustable Curve Brochure**, describing drafting instruments designed to produce accurate circular arcs of long radius, is available from Albert G. Daniels, 109 Chalmers St., Winnsboro, S. C. Specifications and prices of models are included.

**Diazotype Technology Booklet**, Form No. Blb 574 10M 10-57 GPC, is available from Technifax Corp., Holyoke, Mass. Entitled "Technology of the Diazotype Processes," the booklet gives a brief history of the technical print as a means of communication, discusses blueprint vs. diazoprint, the chemistry of diazotype, papers, sensitization and quality.

**Restoration of Mercury Vapor Lamps** by the Nu-Life reconditioning process is described in a brochure offered by Quartz Radiation Corp., 54 Summer St., Newark, N. J.

**Copying Machines Brochure** (FI-328, 10-59), describing a variety of office and engineering uses of Verifax equipment, is offered by Eastman Kodak Co., Business Photo Methods Div., Rochester 4, N. Y.

**Microfilm Service Brochure**, describing a nation-wide film service which consists of a network of selected, independently owned companies specializing in microreproduction equipment and services, is offered by Microdealers, Inc., 1560 Trapelo Rd., Waltham 54, Mass.

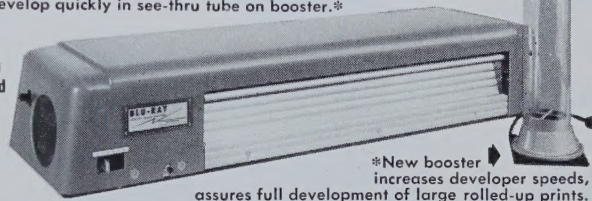
**Whiteprinting Brochure**, Form No. 1275, presenting outstanding design features of Revolute Star whiteprinters—now available in 54-, 42- and 24-inch models—may be requested from Paragon Revolute Corp., 77 South Ave., Rochester 4, N. Y. These new models, equipped with 80, 100 or 150 watt lamps, provide printing speeds up to 75 fpm.

**Planetary Camera Bulletin**, giving specifications of the Photo Devices, Inc., copy camera (Model PD1088) is available from Graphic Microfilm Corp., 115 Liberty St., New York 6, N. Y., distributors of this equipment. The camera has a film size of 70 mm. or 35 mm. and a film capacity of 100 feet; it is an engineering reproduction camera.

## MAKE YOUR OWN WHITEPRINTS!

**PRINTS TAKE ONLY SECONDS . . . COST ONLY PENNIES!**  
So convenient! Saves valuable time. Copies full 42" material, any length. Sharp prints develop quickly in see-thru tube on booster.\*  
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## CHART-PAK Transparent Tapes made this projectable chart in 12 minutes 15 seconds

**HOW LONG  
WOULD IT TAKE  
YOU TO  
DRAW IT?**

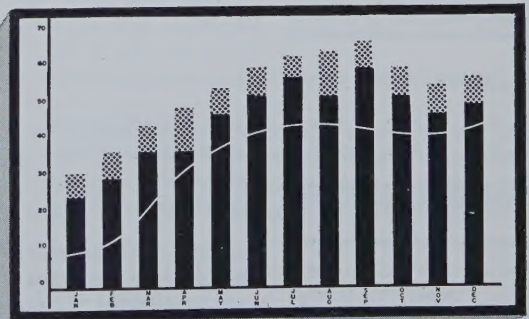
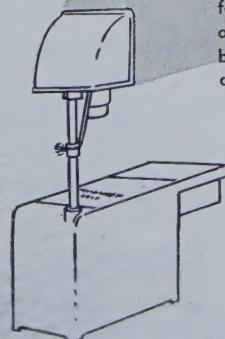


CHART-PAK printed and solid color transparent tapes are specifically designed for audio-visual presentations on overhead projectors. They're ideal for maps, charts, plant layouts, transparencies and slides, as well as for identification. Will not obscure material underneath. In red, blue, green and yellow, precision slit 1/32" to 1" wide, with pressure-sensitive adhesive backing guaranteed not to melt. Write for full details or see your Chart-Pak dealer. He's in the Yellow Pages under "Charts-Business."

**CHART-PAK saves time . . . saves money!**



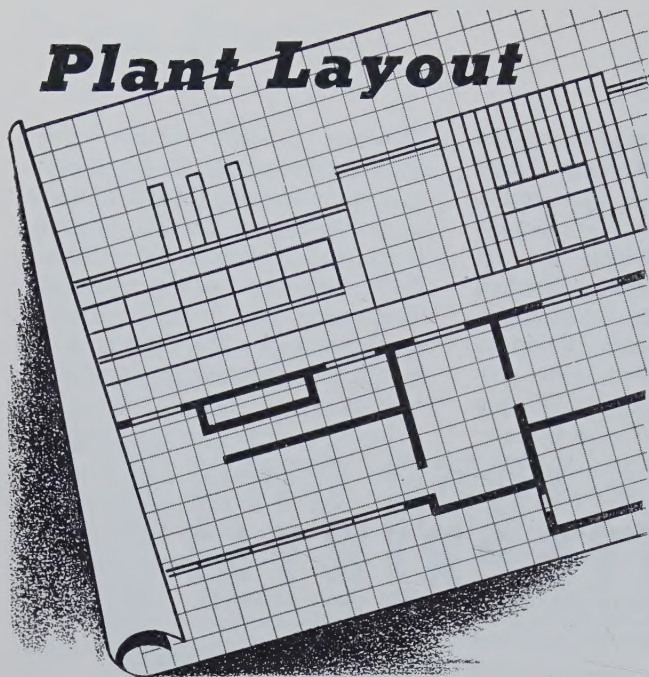
**CHART-PAK, INC.**

ORIGINATOR OF THE TAPE METHOD OF DRAFTING

2912 River Road, Leeds, Mass.

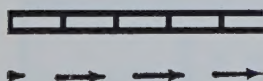


# Plant Layout

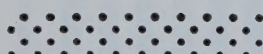


## FAST--EASY--ACCURATE WITH NEW ZIP-A-LINE TAPES

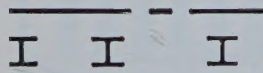
Here is the fastest, the most practical plant layout technique available! The new pressure-sensitive tapes provide a vast selection of signs, symbols, patterns and designs for exacting printed reproductions. Eliminate the tedious task of drawing and re-drawing each and every symbol. Simply place tape in position, press down and cut off—it's finished! Sharp, accurate and in precise register.



**Walls** . . . quickly and easily layed in. Zip it in . . . press down and cut off!



**Roller conveyors, overhead monorails, stairs, and aisles** . . . press down, cut off—it's in! No mess.



**Beams and supports** . . . Like peeling hours off a tape roll. In minutes it's complete.



**Electrical installations** . . . wired on paper in minutes. A zip—and there it is! Quick, easy and economical.

**ZIP-A-LINE TAPES** are the finest—the most complete lines—yes, the most accurately cut tapes in the industry today. Precise width tolerances are maintained throughout the entire roll.



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510 W. Burlington Ave.  
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SAN FRANCISCO — Wettstein, Nowell & Johnson, Inc. Jerry Nowell, 355 Stockton St. YUkon 2-9537.

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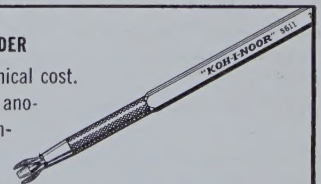


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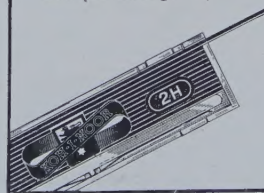
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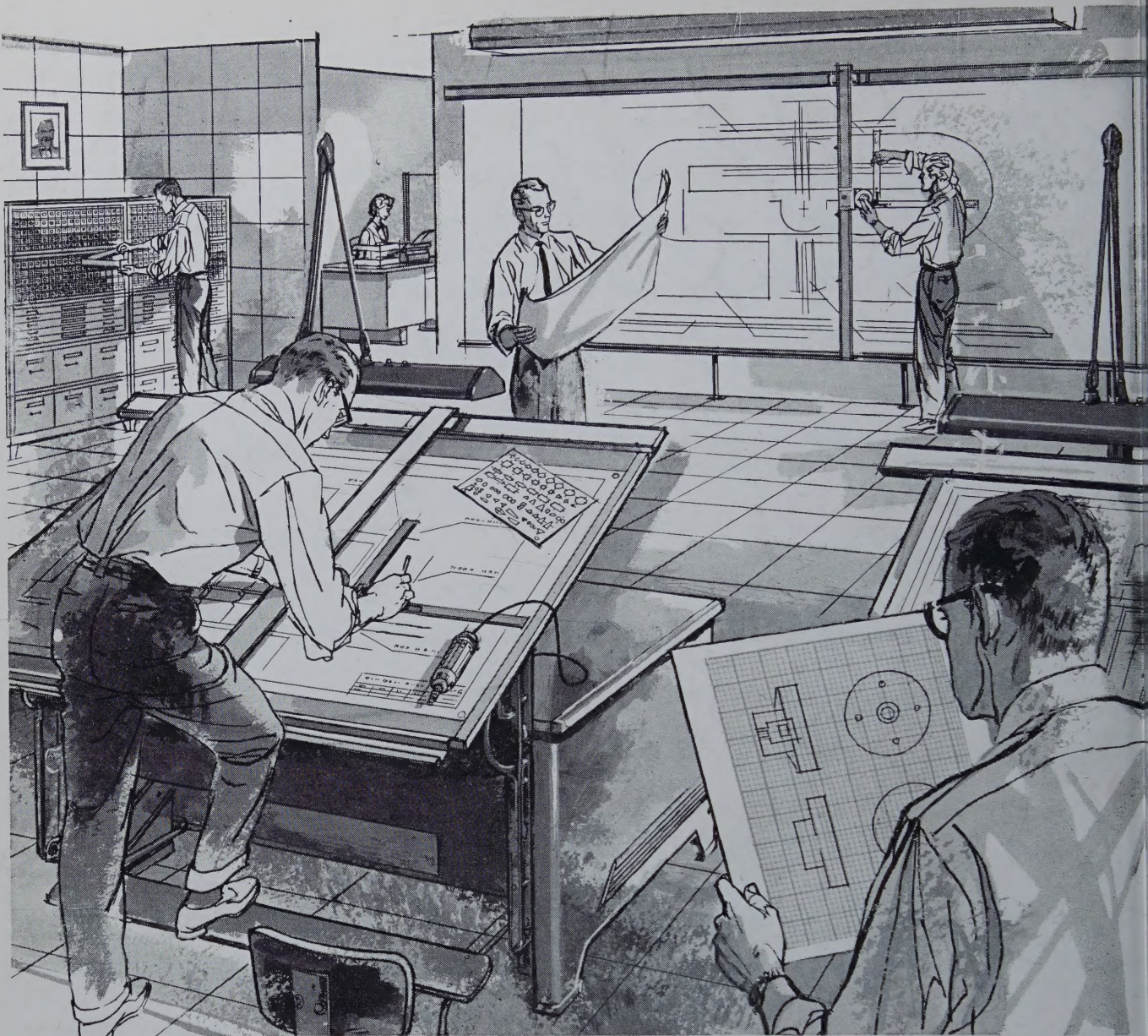
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